JMAP
REGENTS BY PERFORMANCE INDICATOR: TOPIC

NY Algebra 2/Trigonometry Regents Exam Questions from Spring 2009 to January 2016 Sorted by PI: Topic

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1 Howard collected fish eggs from a pond behind his house so he could determine whether sunlight had an effect on how many of the eggs hatched. After he collected the eggs, he divided them into two tanks. He put both tanks outside near the pond, and he covered one of the tanks with a box to block out all sunlight. State whether Howard's investigation was an example of a controlled experiment, an observation, or a survey. Justify your response.

2 Which task is not a component of an observational study?
   1 The researcher decides who will make up the sample.
   2 The researcher analyzes the data received from the sample.
   3 The researcher gathers data from the sample, using surveys or taking measurements.
   4 The researcher divides the sample into two groups, with one group acting as a control group.

3 A doctor wants to test the effectiveness of a new drug on her patients. She separates her sample of patients into two groups and administers the drug to only one of these groups. She then compares the results. Which type of study best describes this situation?
   1 census
   2 survey
   3 observation
   4 controlled experiment

4 A market research firm needs to collect data on viewer preferences for local news programming in Buffalo. Which method of data collection is most appropriate?
   1 census
   2 survey
   3 observation
   4 controlled experiment

5 A school cafeteria has five different lunch periods. The cafeteria staff wants to find out which items on the menu are most popular, so they give every student in the first lunch period a list of questions to answer in order to collect data to represent the school. Which type of study does this represent?
   1 observation
   2 controlled experiment
   3 population survey
   4 sample survey

6 A survey completed at a large university asked 2,000 students to estimate the average number of hours they spend studying each week. Every tenth student entering the library was surveyed. The data showed that the mean number of hours that students spend studying was 15.7 per week. Which characteristic of the survey could create a bias in the results?
   1 the size of the sample
   2 the size of the population
   3 the method of analyzing the data
   4 the method of choosing the students who were surveyed

7 The yearbook staff has designed a survey to learn student opinions on how the yearbook could be improved for this year. If they want to distribute this survey to 100 students and obtain the most reliable data, they should survey
   1 every third student sent to the office
   2 every third student to enter the library
   3 every third student to enter the gym for the basketball game
   4 every third student arriving at school in the morning
8 Which survey is least likely to contain bias?
1 surveying a sample of people leaving a movie theater to determine which flavor of ice cream is the most popular
2 surveying the members of a football team to determine the most watched TV sport
3 surveying a sample of people leaving a library to determine the average number of books a person reads in a year
4 surveying a sample of people leaving a gym to determine the average number of hours a person exercises per week

9 A survey is to be conducted in a small upstate village to determine whether or not local residents should fund construction of a skateboard park by raising taxes. Which segment of the population would provide the most unbiased responses?
1 a club of local skateboard enthusiasts
2 senior citizens living on fixed incomes
3 a group opposed to any increase in taxes
4 every tenth person 18 years of age or older walking down Main St.

11 The table below displays the results of a survey regarding the number of pets each student in a class has. The average number of pets per student in this class is 2.

<table>
<thead>
<tr>
<th>Number of Pets</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td>k</td>
<td>2</td>
</tr>
</tbody>
</table>

What is the value of k for this table?
1 9
2 2
3 8
4 4

12 The table below shows the first-quarter averages for Mr. Harper’s statistics class.

<table>
<thead>
<tr>
<th>Statistics Class Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter Averages</td>
</tr>
<tr>
<td>99</td>
</tr>
<tr>
<td>97</td>
</tr>
<tr>
<td>95</td>
</tr>
<tr>
<td>92</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>87</td>
</tr>
<tr>
<td>84</td>
</tr>
<tr>
<td>81</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>65</td>
</tr>
</tbody>
</table>

What is the population variance for this set of data?
1 8.2
2 8.3
3 67.3
4 69.3
13 The scores of one class on the Unit 2 mathematics test are shown in the table below.

<table>
<thead>
<tr>
<th>Test Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>1</td>
</tr>
<tr>
<td>92</td>
<td>2</td>
</tr>
<tr>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
</tr>
<tr>
<td>76</td>
<td>6</td>
</tr>
<tr>
<td>72</td>
<td>3</td>
</tr>
<tr>
<td>68</td>
<td>2</td>
</tr>
</tbody>
</table>

Find the population standard deviation of these scores, to the nearest tenth.

14 During a particular month, a local company surveyed all its employees to determine their travel times to work, in minutes. The data for all 15 employees are shown below.

25 55 40 65 29
45 59 35 25 37
52 30 8 40 55

Determine the number of employees whose travel time is within one standard deviation of the mean.

15 The heights, in inches, of 10 high school varsity basketball players are 78, 79, 79, 72, 75, 71, 74, 74, 83, and 71. Find the interquartile range of this data set.

16 Ten teams competed in a cheerleading competition at a local high school. Their scores were 29, 28, 39, 37, 45, 40, 41, 38, 37, and 48. How many scores are within one population standard deviation from the mean? For these data, what is the interquartile range?

17 The following is a list of the individual points scored by all twelve members of the Webster High School basketball team at a recent game:

2 2 3 4 6 7 9 10 10 11 12 14

Find the interquartile range for this set of data.

18 The table below shows five numbers and their frequency of occurrence.

<table>
<thead>
<tr>
<th>Number</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>14</td>
<td>8</td>
</tr>
</tbody>
</table>

The interquartile range for these data is

1 7
2 5
3 7 to 12
4 6 to 13

19 The table below shows the final examination scores for Mr. Spear’s class last year.

<table>
<thead>
<tr>
<th>Test Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>1</td>
</tr>
<tr>
<td>76</td>
<td>1</td>
</tr>
<tr>
<td>79</td>
<td>4</td>
</tr>
<tr>
<td>83</td>
<td>5</td>
</tr>
<tr>
<td>85</td>
<td>7</td>
</tr>
<tr>
<td>88</td>
<td>5</td>
</tr>
<tr>
<td>94</td>
<td>3</td>
</tr>
</tbody>
</table>

Find the population standard deviation based on these data, to the nearest hundredth. Determine the number of students whose scores are within one population standard deviation of the mean.
20 The table below displays the number of siblings of each of the 20 students in a class.

<table>
<thead>
<tr>
<th>Number of Siblings</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

What is the population standard deviation, to the nearest hundredth, for this group?

1 1.11  
2 1.12  
3 1.14  
4 1.15  

A2.S.6-7: REGRESSION

21 Samantha constructs the scatter plot below from a set of data.

Based on her scatter plot, which regression model would be most appropriate?

1  exponential  
2  linear  
3  logarithmic  
4  power

22 The table below shows the results of an experiment involving the growth of bacteria.

<table>
<thead>
<tr>
<th>Time (x) (in minutes)</th>
<th>Number of Bacteria (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>81</td>
</tr>
<tr>
<td>7</td>
<td>175</td>
</tr>
<tr>
<td>9</td>
<td>310</td>
</tr>
<tr>
<td>11</td>
<td>497</td>
</tr>
</tbody>
</table>

Write a power regression equation for this set of data, rounding all values to three decimal places. Using this equation, predict the bacteria’s growth, to the nearest integer, after 15 minutes.

23 The table below shows the number of new stores in a coffee shop chain that opened during the years 1986 through 1994.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of New Stores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>14</td>
</tr>
<tr>
<td>1987</td>
<td>27</td>
</tr>
<tr>
<td>1988</td>
<td>48</td>
</tr>
<tr>
<td>1989</td>
<td>80</td>
</tr>
<tr>
<td>1990</td>
<td>110</td>
</tr>
<tr>
<td>1991</td>
<td>153</td>
</tr>
<tr>
<td>1992</td>
<td>261</td>
</tr>
<tr>
<td>1993</td>
<td>403</td>
</tr>
<tr>
<td>1994</td>
<td>681</td>
</tr>
</tbody>
</table>

Using $x = 1$ to represent the year 1986 and $y$ to represent the number of new stores, write the exponential regression equation for these data. Round all values to the nearest thousandth.
24 A population of single-celled organisms was grown in a Petri dish over a period of 16 hours. The number of organisms at a given time is recorded in the table below.

<table>
<thead>
<tr>
<th>Time, hrs ((x))</th>
<th>Number of Organisms ((y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>6</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>10</td>
<td>104</td>
</tr>
<tr>
<td>12</td>
<td>142</td>
</tr>
<tr>
<td>16</td>
<td>260</td>
</tr>
</tbody>
</table>

Determine the exponential regression equation model for these data, rounding all values to the nearest ten-thousandth. Using this equation, predict the number of single-celled organisms, to the nearest whole number, at the end of the 18th hour.

25 A cup of soup is left on a countertop to cool. The table below gives the temperatures, in degrees Fahrenheit, of the soup recorded over a 10-minute period.

<table>
<thead>
<tr>
<th>Time in Minutes ((x))</th>
<th>Temperature in °F ((y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>180.2</td>
</tr>
<tr>
<td>2</td>
<td>165.8</td>
</tr>
<tr>
<td>4</td>
<td>146.3</td>
</tr>
<tr>
<td>6</td>
<td>135.4</td>
</tr>
<tr>
<td>8</td>
<td>127.7</td>
</tr>
<tr>
<td>10</td>
<td>110.5</td>
</tr>
</tbody>
</table>

Write an exponential regression equation for the data, rounding all values to the nearest thousandth.

26 The data collected by a biologist showing the growth of a colony of bacteria at the end of each hour are displayed in the table below.

<table>
<thead>
<tr>
<th>Time, hour ((x))</th>
<th>Population ((y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>1</td>
<td>330</td>
</tr>
<tr>
<td>2</td>
<td>580</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1650</td>
</tr>
<tr>
<td>5</td>
<td>3000</td>
</tr>
</tbody>
</table>

Write an exponential regression equation for the data, rounding all values to the nearest thousandth. Assuming this trend continues, use this equation to estimate, to the nearest ten, the number of bacteria in the colony at the end of 7 hours.

27 The table below shows the concentration of ozone in Earth’s atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding all values to the nearest thousandth.

<table>
<thead>
<tr>
<th>Altitude ((x))</th>
<th>Ozone Units ((y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.7</td>
</tr>
<tr>
<td>5</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>1.1</td>
</tr>
<tr>
<td>15</td>
<td>3.0</td>
</tr>
<tr>
<td>20</td>
<td>4.9</td>
</tr>
</tbody>
</table>

28 The table below shows the amount of a decaying radioactive substance that remained for selected years after 1990.

<table>
<thead>
<tr>
<th>Years After 1990 ((x))</th>
<th>Amount ((y))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>750</td>
</tr>
<tr>
<td>2</td>
<td>451</td>
</tr>
<tr>
<td>5</td>
<td>219</td>
</tr>
<tr>
<td>9</td>
<td>84</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>19</td>
<td>8</td>
</tr>
</tbody>
</table>

Write an exponential regression equation for this set of data, rounding all values to the nearest thousandth. Using this equation, determine the amount of the substance that remained in 2002, to the nearest integer.
29. The table below gives the relationship between $x$ and $y$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>4.2</td>
<td>33.5</td>
<td>113.1</td>
<td>268.1</td>
<td>523.6</td>
</tr>
</tbody>
</table>

Use exponential regression to find an equation for $y$ as a function of $x$, rounding all values to the nearest hundredth. Using this equation, predict the value of $x$ if $y$ is 426.21, rounding to the nearest tenth. [Only an algebraic solution can receive full credit.]

A2.S.8: CORRELATION COEFFICIENT

30. Which value of $r$ represents data with a strong negative linear correlation between two variables?

1. $-1.07$
2. $-0.89$
3. $-0.14$
4. $0.92$

31. Which calculator output shows the strongest linear relationship between $x$ and $y$?

1. Lin Reg
   \[ y = a + bx \]
   \[ a = 59.026 \]
   \[ b = 6.767 \]
   \[ r = .8643 \]

2. Lin Reg
   \[ y = a + bx \]
   \[ a = .7 \]
   \[ b = 24.2 \]
   \[ r = .8361 \]

3. Lin Reg
   \[ y = a + bx \]
   \[ a = 2.45 \]
   \[ b = .95 \]
   \[ r = .6022 \]

4. Lin Reg
   \[ y = a + bx \]
   \[ a = -2.9 \]
   \[ b = 24.1 \]
   \[ r = -.8924 \]

32. As shown in the table below, a person’s target heart rate during exercise changes as the person gets older.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Target Heart Rate (beats per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>135</td>
</tr>
<tr>
<td>25</td>
<td>132</td>
</tr>
<tr>
<td>30</td>
<td>129</td>
</tr>
<tr>
<td>35</td>
<td>125</td>
</tr>
<tr>
<td>40</td>
<td>122</td>
</tr>
<tr>
<td>45</td>
<td>119</td>
</tr>
<tr>
<td>50</td>
<td>115</td>
</tr>
</tbody>
</table>

Which value represents the linear correlation coefficient, rounded to the nearest thousandth, between a person’s age, in years, and that person’s target heart rate, in beats per minute?

1. $-0.999$
2. $-0.664$
3. $0.998$
4. $1.503$

33. The relationship between $t$, a student’s test scores, and $d$, the student’s success in college, is modeled by the equation $d = 0.48t + 75.2$. Based on this linear regression model, the correlation coefficient could be

1. between $-1$ and $0$
2. between $0$ and $1$
3. equal to $-1$
4. equal to $0$

34. Which value of $r$ represents data with a strong positive linear correlation between two variables?

1. $0.89$
2. $0.34$
3. $1.04$
4. $0.01$
35 Determine which set of data given below has the stronger linear relationship between \( x \) and \( y \). Justify your choice.

\[
\begin{array}{c|cccccc}
\text{Set A} & 1 & 2 & 3 & 4 & 5 & 6 \\
\hline
x & 24 & 30 & 36 & 51 & 70 & 88 \\
y & 81 & 64 & 49 & 36 & 25 & 18 \\
\end{array}
\]

36 A study compared the number of years of education a person received and that person's average yearly salary. It was determined that the relationship between these two quantities was linear and the correlation coefficient was 0.91. Which conclusion can be made based on the findings of this study?
1. There was a weak relationship.
2. There was a strong relationship.
3. There was no relationship.
4. There was an unpredictable relationship.

37 Which statement regarding correlation is not true?
1. The closer the absolute value of the correlation coefficient is to one, the closer the data conform to a line.
2. A correlation coefficient measures the strength of the linear relationship between two variables.
3. A negative correlation coefficient indicates that there is a weak relationship between two variables.
4. A relation for which most of the data fall close to a line is considered strong.

A2.S.5: NORMAL DISTRIBUTIONS

38 The lengths of 100 pipes have a normal distribution with a mean of 102.4 inches and a standard deviation of 0.2 inch. If one of the pipes measures exactly 102.1 inches, its length lies
1. below the 16\(^{th}\) percentile
2. between the 50\(^{th}\) and 84\(^{th}\) percentiles
3. between the 16\(^{th}\) and 50\(^{th}\) percentiles
4. above the 84\(^{th}\) percentile

39 An amateur bowler calculated his bowling average for the season. If the data are normally distributed, about how many of his 50 games were within one standard deviation of the mean?
1. 14
2. 17
3. 34
4. 48

40 Assume that the ages of first-year college students are normally distributed with a mean of 19 years and standard deviation of 1 year. To the nearest integer, find the percentage of first-year college students who are between the ages of 18 years and 20 years, inclusive. To the nearest integer, find the percentage of first-year college students who are 20 years old or older.

41 In a study of 82 video game players, the researchers found that the ages of these players were normally distributed, with a mean age of 17 years and a standard deviation of 3 years. Determine if there were 15 video game players in this study over the age of 20. Justify your answer.

42 If the amount of time students work in any given week is normally distributed with a mean of 10 hours per week and a standard deviation of 2 hours, what is the probability a student works between 8 and 11 hours per week?
1. 34.1%
2. 38.2%
3. 53.2%
4. 68.2%

43 In a certain high school, a survey revealed the mean amount of bottled water consumed by students each day was 153 bottles with a standard deviation of 22 bottles. Assuming the survey represented a normal distribution, what is the range of the number of bottled waters that approximately 68.2% of the students drink?
1. 131 – 164
2. 131 – 175
3. 142 – 164
4. 142 – 175
44 Liz has applied to a college that requires students to score in the top 6.7% on the mathematics portion of an aptitude test. The scores on the test are approximately normally distributed with a mean score of 576 and a standard deviation of 104. What is the minimum score Liz must earn to meet this requirement?
   1 680
   2 732
   3 740
   4 784

45 In a certain school, the heights of the population of girls are normally distributed, with a mean of 63 inches and a standard deviation of 2 inches. If there are 450 girls in the school, determine how many of the girls are shorter than 60 inches. Round the answer to the nearest integer.

46 On a test that has a normal distribution of scores, a score of 57 falls one standard deviation below the mean, and a score of 81 is two standard deviations above the mean. Determine the mean score of this test.

47 The scores on a standardized exam have a mean of 82 and a standard deviation of 3.6. Assuming a normal distribution, a student's score of 91 would rank
   1 below the 75th percentile
   2 between the 75th and 85th percentiles
   3 between the 85th and 95th percentiles
   4 above the 95th percentile

48 The scores of 1000 students on a standardized test were normally distributed with a mean of 50 and a standard deviation of 5. What is the expected number of students who had scores greater than 60?
   1 1.7
   2 23
   3 46
   4 304

PROBABILITY
A2.S.10: PERMUTATIONS

49 Which formula can be used to determine the total number of different eight-letter arrangements that can be formed using the letters in the word DEADLINE?
   1 $8!$
   2 $\frac{8!}{4!}$
   3 $\frac{8!}{2!+2!}$
   4 $\frac{8!}{2!\cdot2!}$

50 The letters of any word can be rearranged. Carol believes that the number of different 9-letter arrangements of the word “TENNESSEE” is greater than the number of different 7-letter arrangements of the word “VERMONT.” Is she correct? Justify your answer.

51 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word PENNSYLVANIA.

52 A four-digit serial number is to be created from the digits 0 through 9. How many of these serial numbers can be created if 0 can not be the first digit, no digit may be repeated, and the last digit must be 5?
   1 448
   2 504
   3 2,240
   4 2,520

53 How many different six-letter arrangements can be made using the letters of the word “TATTOO”? 
   1 60
   2 90
   3 120
   4 720

54 Find the number of possible different 10-letter arrangements using the letters of the word “STATISTICS.”
55 Which expression represents the total number of different 11-letter arrangements that can be made using the letters in the word “MATHEMATICS”?
1 \( \frac{11!}{3!} \)
2 \( \frac{11!}{2!+2!+2!} \)
3 \( \frac{11!}{8!} \)
4 \( \frac{11!}{2!+2!+2!} \)

56 The number of possible different 12-letter arrangements of the letters in the word “TRIGONOMETRY” is represented by
1 \( \frac{12!}{3!} \)
2 \( \frac{12!}{6!} \)
3 \( \frac{\binom{12}{12}}{8} \)
4 \( \frac{\binom{12}{12}}{6!} \)

57 How many different 11-letter arrangements are possible using the letters in the word “ARRANGEMENT”?
1 2,494,800
2 4,989,600
3 19,958,400
4 39,916,800

58 What is the total number of different nine-letter arrangements that can be formed using the letters in the word “TENNESSEE”?
1 3,780
2 15,120
3 45,360
4 362,880

59 How many distinct ways can the eleven letters in the word "TALLAHASSEE" be arranged?
1 831,600
2 1,663,200
3 3,326,400
4 5,702,400

60 Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

A2.S.11: COMBINATIONS

61 The principal would like to assemble a committee of 8 students from the 15-member student council. How many different committees can be chosen?
1 120
2 6,435
3 32,432,400
4 259,459,200

62 Ms. Bell's mathematics class consists of 4 sophomores, 10 juniors, and 5 seniors. How many different ways can Ms. Bell create a four-member committee of juniors if each junior has an equal chance of being selected?
1 210
2 3,876
3 5,040
4 93,024

63 A blood bank needs twenty people to help with a blood drive. Twenty-five people have volunteered. Find how many different groups of twenty can be formed from the twenty-five volunteers.

64 If order does not matter, which selection of students would produce the most possible committees?
1 5 out of 15
2 5 out of 25
3 20 out of 25
4 15 out of 25

65 How many different ways can teams of four members be formed from a class of 20 students?
1 5
2 80
3 4,845
4 116,280
66. A customer will select three different toppings for a supreme pizza. If there are nine different toppings to choose from, how many different supreme pizzas can be made?

1. 12
2. 27
3. 84
4. 504

A2.S.9: DIFFERENTIATING BETWEEN PERMUTATIONS AND COMBINATIONS

67. Twenty different cameras will be assigned to several boxes. Three cameras will be randomly selected and assigned to box $A$. Which expression can be used to calculate the number of ways that three cameras can be assigned to box $A$?

1. $20!$
2. $\frac{20!}{3!}$
3. $20 \binom{3}$
4. $20 \binom{3}$

68. Three marbles are to be drawn at random, without replacement, from a bag containing 15 red marbles, 10 blue marbles, and 5 white marbles. Which expression can be used to calculate the probability of drawing 2 red marbles and 1 white marble from the bag?

1. $\frac{15 \binom{2} \cdot 5 \binom{1}}{30 \binom{3}}$
2. $\frac{15 \binom{2} \cdot 5 \binom{1}}{30 \binom{3}}$
3. $\frac{15 \binom{2} \cdot 5 \binom{1}}{30 \binom{3}}$
4. $\frac{15 \binom{2} \cdot 5 \binom{1}}{30 \binom{3}}$

69. There are eight people in a tennis club. Which expression can be used to find the number of different ways they can place first, second, and third in a tournament?

1. $8 \binom{3}$
2. $8 \binom{3}$
3. $8 \binom{5}$
4. $8 \binom{5}$

70. Which problem involves evaluating $6 \binom{4}$?

1. How many different four-digit ID numbers can be formed using 1, 2, 3, 4, 5, and 6 without repetition?
2. How many different subcommittees of four can be chosen from a committee having six members?
3. How many different outfits can be made using six shirts and four pairs of pants?
4. How many different ways can one boy and one girl be selected from a group of four boys and six girls?

71. A math club has 30 boys and 20 girls. Which expression represents the total number of different 5-member teams, consisting of 3 boys and 2 girls, that can be formed?

1. $30 \binom{3} \cdot 20 \binom{2}$
2. $30 \binom{3} \cdot 20 \binom{2}$
3. $30 \binom{3} + 20 \binom{2}$
4. $30 \binom{3} + 20 \binom{2}$

72. A video-streaming service can choose from six half-hour shows and four one-hour shows. Which expression could be used to calculate the number of different ways the service can choose four half-hour shows and two one-hour shows?

1. $6 \binom{4} \cdot 4 \binom{2}$
2. $6 \binom{4} + 4 \binom{2}$
3. $6 \binom{4} \cdot 4 \binom{2}$
4. $6 \binom{4} + 4 \binom{2}$
73. Six people met at a dinner party, and each person shook hands once with everyone there. Which expression represents the total number of handshakes?

1. \(6!\)
2. \(6! \cdot 2!\)
3. \(\frac{6!}{2!}\)
4. \(\frac{6!}{4! \cdot 2!}\)

A2.S.12: SAMPLE SPACE

74. A committee of 5 members is to be randomly selected from a group of 9 teachers and 20 students. Determine how many different committees can be formed if 2 members must be teachers and 3 members must be students.

75. A school math team consists of three juniors and five seniors. How many different groups can be formed that consist of one junior and two seniors?

1. 13
2. 15
3. 30
4. 60

A2.S.13: GEOMETRIC PROBABILITY

76. A dartboard is shown in the diagram below. The two lines intersect at the center of the circle, and the central angle in sector 2 measures \(\frac{2\pi}{3}\). If darts thrown at this board are equally likely to land anywhere on the board, what is the probability that a dart that hits the board will land in either sector 1 or sector 3?

1. \(\frac{1}{6}\)
2. \(\frac{1}{3}\)
3. \(\frac{1}{2}\)
4. \(\frac{2}{3}\)

A2.S.15: BINOMIAL PROBABILITY

77. The members of a men’s club have a choice of wearing black or red vests to their club meetings. A study done over a period of many years determined that the percentage of black vests worn is 60%. If there are 10 men at a club meeting on a given night, what is the probability, to the nearest thousandth, that at least 8 of the vests worn will be black?
78 A study shows that 35% of the fish caught in a local lake had high levels of mercury. Suppose that 10 fish were caught from this lake. Find, to the nearest tenth of a percent, the probability that at least 8 of the 10 fish caught did not contain high levels of mercury.

79 The probability that the Stormville Sluggers will win a baseball game is \( \frac{2}{3} \). Determine the probability, to the nearest thousandth, that the Stormville Sluggers will win at least 6 of their next 8 games.

80 The probability that a professional baseball player will get a hit is \( \frac{1}{3} \). Calculate the exact probability that he will get at least 3 hits in 5 attempts.

81 A spinner is divided into eight equal sections. Five sections are red and three are green. If the spinner is spun three times, what is the probability that it lands on red exactly twice?

82 A study finds that 80% of the local high school students text while doing homework. Ten students are selected at random from the local high school. Which expression would be part of the process used to determine the probability that, at most, 7 of the 10 students text while doing homework?

1. \( \binom{10}{6} \left( \frac{4}{5} \right)^6 \left( \frac{1}{5} \right)^4 \)
2. \( \binom{10}{7} \left( \frac{4}{5} \right)^7 \left( \frac{1}{5} \right)^3 \)
3. \( \binom{10}{8} \left( \frac{7}{10} \right)^8 \left( \frac{3}{10} \right)^2 \)
4. \( \binom{10}{9} \left( \frac{7}{10} \right)^9 \left( \frac{3}{10} \right)^1 \)

83 On a multiple-choice test, Abby randomly guesses on all seven questions. Each question has four choices. Find the probability, to the nearest thousandth, that Abby gets exactly three questions correct.

84 Because Sam’s backyard gets very little sunlight, the probability that a geranium planted there will flower is 0.28. Sam planted five geraniums. Determine the probability, to the nearest thousandth, that at least four geraniums will flower.

85 Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

86 The probability of Ashley being the catcher in a softball game is \( \frac{2}{5} \). Calculate the exact probability that she will be the catcher in exactly five of the next six games.

87 The probability that Kay and Joseph Dowling will have a redheaded child is 1 out of 4. If the Dowlings plan to have three children, what is the exact probability that only one child will have red hair?
88 The probability of winning a game is $\frac{2}{3}$.
Determine the probability, expressed as a fraction, of winning exactly four games if seven games are played.

89 In the diagram below, the spinner is divided into eight equal regions.

Which expression represents the probability of the spinner landing on $B$ exactly three times in five spins?

1. $\binom{5}{3} \left(\frac{1}{5}\right)^3 \left(\frac{4}{5}\right)^2$
2. $\binom{5}{3} \left(\frac{1}{5}\right)^3 \left(\frac{4}{5}\right)^2$
3. $\binom{5}{3} \left(\frac{1}{8}\right)^2 \left(\frac{7}{8}\right)^3$
4. $\binom{5}{3} \left(\frac{1}{8}\right)^3 \left(\frac{7}{8}\right)^2$

90 What is the solution set of the equation $|4a + 6| - 4a = -10$?
1. $\emptyset$
2. $\{0\}$
3. $\left\{\frac{1}{2}\right\}$
4. $\left\{0, \frac{1}{2}\right\}$

91 What is the solution set of $|x - 2| = 3x + 10$?
1. $\{\}$
2. $\{-2\}$
3. $\{-6\}$
4. $\{-2, -6\}$

92 Which graph represents the solution set of $|6x - 7| \leq 5$?

93 Solve the inequality $-3|6 - x| < -15$ for $x$. Graph the solution on the line below.

94 Which graph represents the solution set of $\left|\frac{4x - 5}{3}\right| > 1$?
95 Determine the solution of the inequality \( |3 - 2x| \geq 7 \). [The use of the grid below is optional.]

96 What is the graph of the solution set of \( |2x - 1| > 5 \)?

97 Solve \( |4x + 5| < 13 \) algebraically for \( x \).

98 Solve \( |2x - 3| > 5 \) algebraically.

99 Solve algebraically for \( x \): \( |3x - 5| - x < 17 \)

100 Which graph is the solution to the inequality \( 4|2x + 6| - 5 < 27 \)?

101 Find the sum and product of the roots of the equation \( 5x^2 + 11x - 3 = 0 \).

102 What are the sum and product of the roots of the equation \( 6x^2 - 4x - 12 = 0 \)?

103 Determine the sum and the product of the roots of \( 3x^2 = 11x - 6 \).

104 Determine the sum and the product of the roots of the equation \( 12x^2 + x - 6 = 0 \).

105 What is the product of the roots of the quadratic equation \( 2x^2 - 7x = 5 \)?

106 What is the product of the roots of \( 4x^2 - 5x = 3 \)?

107 Given the equation \( 3x^2 + 2x + k = 0 \), state the sum and product of the roots.
108 Which statement about the equation 
\[3x^2 + 9x - 12 = 0\] is true?
1 The product of the roots is \(-12\).
2 The product of the roots is \(-4\).
3 The sum of the roots is 3.
4 The sum of the roots is \(-9\).

109 What is the sum of the roots of the equation 
\[-3x^2 + 6x - 2 = 0?\]
1 \(\frac{2}{3}\)
2 2
3 \(-\frac{2}{3}\)
4 \(-2\)

110 For which equation does the sum of the roots equal \(\frac{3}{4}\) and the product of the roots equal \(-2\)?
1 \(4x^2 - 8x + 3 = 0\)
2 \(4x^2 + 8x + 3 = 0\)
3 \(4x^2 - 3x - 8 = 0\)
4 \(4x^2 + 3x - 2 = 0\)

111 For which equation does the sum of the roots equal \(-3\) and the product of the roots equal 2? 
1 \(x^2 + 2x - 3 = 0\)
2 \(x^2 - 3x + 2 = 0\)
3 \(2x^2 + 6x + 4 = 0\)
4 \(2x^2 - 6x + 4 = 0\)

112 Write a quadratic equation such that the sum of its roots is 6 and the product of its roots is \(-27\).

113 Which equation has roots with the sum equal to \(\frac{9}{4}\) and the product equal to \(\frac{3}{4}\)?
1 \(4x^2 + 9x + 3 = 0\)
2 \(4x^2 + 9x - 3 = 0\)
3 \(4x^2 - 9x + 3 = 0\)
4 \(4x^2 - 9x - 3 = 0\)

114 What is the product of the roots of \(x^2 - 4x + k = 0\) if one of the roots is 7?
1 21
2 \(-11\)
3 \(-21\)
4 \(-77\)

115 Factored completely, the expression \(6x - x^3 - x^2\) is equivalent to
1 \(x(x + 3)(x - 2)\)
2 \(x(x - 3)(x + 2)\)
3 \(-x(x - 3)(x + 2)\)
4 \(-x(x + 3)(x - 2)\)

116 Factored completely, the expression \(12x^4 + 10x^3 - 12x^2\) is equivalent to
1 \(x^2(4x + 6)(3x - 2)\)
2 \(2(2x^2 + 3x)(3x^2 - 2x)\)
3 \(2x^2(2x - 3)(3x + 2)\)
4 \(2x^2(2x + 3)(3x - 2)\)

117 Factor completely: \(10ax^2 - 23ax - 5a\)

118 Factor the expression \(12t^8 - 75t^4\) completely.

119 When factored completely, \(x^3 + 3x^2 - 4x - 12\) equals
1 \((x + 2)(x - 2)(x - 3)\)
2 \((x + 2)(x - 2)(x + 3)\)
3 \((x^2 - 4)(x + 3)\)
4 \((x^2 - 4)(x - 3)\)
120 When factored completely, the expression 
\[3x^3 - 5x^2 - 48x + 80\] is equivalent to 
1 \[(x^2 - 16)(3x - 5)\]
2 \[(x^2 + 16)(3x - 5)(3x + 5)\]
3 \[(x + 4)(x - 4)(3x - 5)\]
4 \[(x + 4)(x - 4)(3x - 5)(3x - 5)\]

121 The expression \[x^2(x + 2) - (x + 2)\] is equivalent to 
1 \[x^2\]
2 \[x^2 - 1\]
3 \[x^3 + 2x^2 - x + 2\]
4 \[(x + 1)(x - 1)(x + 2)\]

122 When factored completely, the expression 
\[x^3 - 2x^2 - 9x + 18\] is equivalent to 
1 \[(x^2 - 9)(x - 2)\]
2 \[(x - 2)(x - 3)(x + 3)\]
3 \[(x - 2)^2(x - 3)(x + 3)\]
4 \[(x - 3)^2(x - 2)\]

123 Factor completely: \[x^3 - 6x^2 - 25x + 150\]

124 Factor completely: \[x^3 + 3x^2 + 2x + 6\]

**A2.A.25: QUADRATIC FORMULA**

125 The solutions of the equation \[y^2 - 3y = 9\] are 
1 \[\frac{3 \pm 3i\sqrt{3}}{2}\]
2 \[\frac{3 \pm 3i\sqrt{5}}{2}\]
3 \[\frac{-3 \mp 3\sqrt{5}}{2}\]
4 \[\frac{3 \mp 3\sqrt{5}}{2}\]

126 The roots of the equation \[2x^2 + 7x - 3 = 0\] are 
1 \[\frac{1}{2} \text{ and } -3\]
2 \[\frac{1}{2} \text{ and } 3\]
3 \[\frac{-7 \pm \sqrt{73}}{4}\]
4 \[\frac{7 \pm \sqrt{73}}{4}\]

127 Solve the equation \[6x^2 - 2x - 3 = 0\] and express the answer in simplest radical form.

128 A cliff diver on a Caribbean island jumps from a height of 105 feet, with an initial upward velocity of 5 feet per second. An equation that models the height, \[h(t)\], above the water, in feet, of the diver in time elapsed, \(t\), in seconds, is \[h(t) = -16t^2 + 5t + 105\]. How many seconds, to the nearest hundredth, does it take the diver to fall 45 feet below his starting point?

1 1.45
2 1.84
3 2.10
4 2.72

129 A homeowner wants to increase the size of a rectangular deck that now measures 14 feet by 22 feet. The building code allows for a deck to have a maximum area of 800 square feet. If the length and width are increased by the same number of feet, find the maximum number of whole feet each dimension can be increased and not exceed the building code. [Only an algebraic solution can receive full credit.]

**A2.A.2: USING THE DISCRIMINANT**

130 Use the discriminant to determine all values of \(k\) that would result in the equation \[x^2 - kx + 4 = 0\] having equal roots.
131 The roots of the equation $9x^2 + 3x - 4 = 0$ are
1 imaginary
2 real, rational, and equal
3 real, rational, and unequal
4 real, irrational, and unequal

132 The roots of the equation $x^2 - 10x + 25 = 0$ are
1 imaginary
2 real and irrational
3 real, rational, and equal
4 real, rational, and unequal

133 The discriminant of a quadratic equation is 24. The roots are
1 imaginary
2 real, rational, and equal
3 real, rational, and unequal
4 real, irrational, and unequal

134 The roots of the equation $2x^2 + 4 = 9x$ are
1 real, rational, and equal
2 real, rational, and unequal
3 real, irrational, and unequal
4 imaginary

135 For which value of $k$ will the roots of the equation $2x^2 - 5x + k = 0$ be real and rational numbers?
1 1
2 -5
3 0
4 4

136 Which equation has real, rational, and unequal roots?
1 $x^2 + 10x + 25 = 0$
2 $x^2 - 5x + 4 = 0$
3 $x^2 - 3x + 1 = 0$
4 $x^2 - 2x + 5 = 0$

137 The roots of $3x^2 + x = 14$ are
1 imaginary
2 real, rational, and equal
3 real, rational, and unequal
4 real, irrational, and unequal

138 The roots of the equation $4(x^2 - 1) = -3x$ are
1 imaginary
2 real, rational, equal
3 real, rational, unequal
4 real, irrational, unequal

A2.A.24: COMPLETING THE SQUARE

139 Solve $2x^2 - 12x + 4 = 0$ by completing the square, expressing the result in simplest radical form.

140 If $x^2 + 2 = 6x$ is solved by completing the square, an intermediate step would be
1 $(x + 3)^2 = 7$
2 $(x - 3)^2 = 7$
3 $(x - 3)^2 = 11$
4 $(x - 6)^2 = 34$

141 Brian correctly used a method of completing the square to solve the equation $x^2 + 7x - 11 = 0$. Brian’s first step was to rewrite the equation as $x^2 + 7x = 11$. He then added a number to both sides of the equation. Which number did he add?
1 $\frac{7}{2}$
2 $\frac{49}{4}$
3 $\frac{49}{2}$
4 49

142 Max solves a quadratic equation by completing the square. He shows a correct step:
\[(x + 2)^2 = -9\]
What are the solutions to his equation?
1 $2 \pm 3i$
2 $-2 \pm 3i$
3 $3 \pm 2i$
4 $-3 \pm 2i$
143 Which step can be used when solving
\[ x^2 - 6x - 25 = 0 \] by completing the square?
1. \[ x^2 - 6x + 9 = 25 + 9 \]
2. \[ x^2 - 6x - 9 = 25 - 9 \]
3. \[ x^2 - 6x + 36 = 25 + 36 \]
4. \[ x^2 - 6x - 36 = 25 - 36 \]

144 If \( x^2 = 12x - 7 \) is solved by completing the square, one of the steps in the process is
1. \( (x - 6)^2 = -43 \)
2. \( (x + 6)^2 = -43 \)
3. \( (x - 6)^2 = 29 \)
4. \( (x + 6)^2 = 29 \)

145 Which value of \( k \) will make \( x^2 - \frac{1}{4}x + k \) a perfect square trinomial?
1. \( \frac{1}{64} \)
2. \( \frac{1}{16} \)
3. \( \frac{1}{8} \)
4. \( \frac{1}{4} \)

146 Find the exact roots of \( x^2 + 10x - 8 = 0 \) by completing the square.

A2.A.4: QUADRATIC INEQUALITIES

147 Which graph best represents the inequality
\[ y + 6 \geq x^2 - x? \]
148 The solution set of the inequality $x^2 - 3x > 10$ is
1  $\{x | -2 < x < 5\}$
2  $\{x | 0 < x < 3\}$
3  $\{x | x < -2 \text{ or } x > 5\}$
4  $\{x | x < -5 \text{ or } x > 2\}$

149 The solution of the inequality $x^2 - 4x > 5$, algebraically.

150 What is the solution of the inequality $9 - x^2 < 0$?
1  $\{x | -3 < x < 3\}$
2  $\{x | x > 3 \text{ or } x < -3\}$
3  $\{x | x > 3\}$
4  $\{x | x < -3\}$

151 Which values of $x$ are in the solution set of the following system of equations?
\begin{align*}
y &= 3x - 6 \\
y &= x^2 - x - 6
\end{align*}
1  0, -4
2  0, 4
3  6, -2
4  -6, 2

152 Solve the following systems of equations algebraically:
\[5 = y - x\]
\[4x^2 = -17x + y + 4\]

153 Which ordered pair is a solution of the system of equations shown below? $x + y = 5$
\[(x + 3)^2 + (y - 3)^2 = 53\]
1  (2, 3)
2  (5, 0)
3  (-5, 10)
4  (-4, 9)

154 Which ordered pair is in the solution set of the system of equations shown below?
\[y^2 - x^2 + 32 = 0\]
\[3y - x = 0\]
1  (2, 6)
2  (3, 1)
3  (-1, -3)
4  (-6, -2)

155 Determine algebraically the $x$-coordinate of all points where the graphs of $xy = 10$ and $y = x + 3$ intersect.

156 What is the total number of points of intersection of the graphs of the equations $2x^2 - y^2 = 8$ and $y = x + 2$?
1  1
2  2
3  3
4  0

POWERS
A2.N.3: OPERATIONS WITH POLYNOMIALS

157 Express $\left(\frac{2}{3}x - 1\right)^2$ as a trinomial.

158 When $\frac{3}{2}x^2 - \frac{1}{4}x - 4$ is subtracted from $\frac{5}{2}x^2 - \frac{3}{4}x + 1$, the difference is
\begin{align*}
1 & -x^2 + \frac{1}{2}x - 5 \\
2 & x^2 - \frac{1}{2}x + 5 \\
3 & -x^2 - x - 3 \\
4 & x^2 - x - 3
\end{align*}

159 Express the product of $\left(\frac{1}{2}y^2 - \frac{1}{3}y\right)$ and $\left(12y + \frac{3}{5}\right)$ as a trinomial.
### Algebra 2/Trigonometry Regents Exam Questions by Performance Indicator: Topic

#### 160 What is the product of \( \left( \frac{x}{4} - \frac{1}{3} \right) \) and \( \left( \frac{x}{4} + \frac{1}{3} \right) \)?

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<td>2</td>
<td>( \frac{x^2}{16} - \frac{1}{9} )</td>
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<td>3</td>
<td>( \frac{x^2}{8} - \frac{x}{6} - \frac{1}{9} )</td>
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<td>4</td>
<td>( \frac{x^2}{16} - \frac{x}{6} - \frac{1}{9} )</td>
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#### 161 What is the product of \( \left( \frac{2}{5} x - \frac{3}{4} y^2 \right) \) and 
\( \left( \frac{2}{5} x + \frac{3}{4} y^2 \right) \)?

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<td>2</td>
<td>( \frac{4}{25} x - \frac{9}{16} y^2 )</td>
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<td>3</td>
<td>( \frac{2}{5} x^2 - \frac{3}{4} y^4 )</td>
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<tr>
<td>4</td>
<td>( \frac{4}{5} x )</td>
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#### 162 When \( x^2 + 3x - 4 \) is subtracted from \( x^3 + 3x^2 - 2x \), the difference is

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<td>( x^3 + 2x^2 - 5x + 4 )</td>
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<td>2</td>
<td>( x^3 + 2x^2 + x - 4 )</td>
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<td>3</td>
<td>( -x^3 + 4x^2 + x - 4 )</td>
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<td>4</td>
<td>( -x^3 - 2x^2 + 5x + 4 )</td>
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#### 163 The expression \( \left( \frac{3}{2} x + 1 \right) \left( \frac{3}{2} x - 1 \right) - \left( \frac{3}{2} x - 1 \right)^2 \) is equivalent to

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<td>1</td>
<td>0</td>
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<td>2</td>
<td>(-3x)</td>
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<tr>
<td>3</td>
<td>( \frac{3}{4} x - 2 )</td>
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<tr>
<td>4</td>
<td>( 3x - 2 )</td>
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#### 164 When \( \frac{7}{8} x^2 - \frac{3}{4} x \) is subtracted from \( \frac{5}{8} x^2 - \frac{1}{4} x + 2 \), the difference is

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<td>( \frac{1}{4} x^2 - x + 2 )</td>
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<tr>
<td>2</td>
<td>( \frac{1}{4} x^2 - x + 2 )</td>
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<td></td>
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<tr>
<td>3</td>
<td>( \frac{1}{4} x^2 + \frac{1}{2} x + 2 )</td>
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<tr>
<td>4</td>
<td>( \frac{1}{4} x^2 - \frac{1}{2} x - 2 )</td>
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#### 165 Find the difference when \( \frac{4}{3} x^3 - \frac{5}{8} x^2 + \frac{7}{5} x \) is subtracted from \( 2x^3 + \frac{3}{4} x^2 - \frac{2}{9} \).

#### 166 If \( a = 3 \) and \( b = -2 \), what is the value of the expression \( \frac{a^{-2}}{b^{-3}} \)?

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<td>1</td>
<td>( \frac{9}{8} )</td>
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<td>2</td>
<td>(-1)</td>
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<td>( \frac{8}{9} )</td>
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<td>4</td>
<td>( \frac{8}{9} )</td>
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#### 167 If \( n \) is a negative integer, then which statement is always true?

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<td>( 6n^{-2} &lt; 4n^{-1} )</td>
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<tr>
<td>2</td>
<td>( \frac{n}{4} &gt; -6n^{-1} )</td>
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<tr>
<td>3</td>
<td>( 6n^{-1} &lt; 4n^{-1} )</td>
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<tr>
<td>4</td>
<td>( 4n^{-1} &gt; (6n)^{-1} )</td>
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A2.N.1, A.8-9: NEGATIVE AND FRACTIONAL EXPONENTS
168 What is the value of \(4x^2 + x^0 + x^{-4}\) when \(x = 16\)?

1. \(7\frac{1}{2}\)
2. \(9\frac{1}{2}\)
3. \(16\frac{1}{2}\)
4. \(17\frac{1}{2}\)

169 When simplified, the expression \(\left(\frac{w^{-5}}{w^{-9}}\right)^{\frac{1}{2}}\) is equivalent to

1. \(w^{-7}\)
2. \(w^2\)
3. \(w^7\)
4. \(w^{14}\)

170 Which expression is equivalent to \(\left(9x^2y^6\right)^{-\frac{1}{2}}\)?

1. \(\frac{1}{3xy^3}\)
2. \(3xy^3\)
3. \(\frac{3}{xy^3}\)
4. \(\frac{xy^3}{3}\)

171 Which expression is equivalent to \(\left(3x^2\right)^{-1}\)?

1. \(\frac{1}{3x^2}\)
2. \(-3x^2\)
3. \(\frac{1}{9x^2}\)
4. \(-9x^2\)

172 The expression \((2a)^{-4}\) is equivalent to

1. \(-8a^4\)
2. \(\frac{16}{a^4}\)
3. \(\frac{2}{a^4}\)
4. \(\frac{1}{16a^4}\)

173 The expression \(\frac{a^2b^{-3}}{a^{-4}b^2}\) is equivalent to

1. \(\frac{a^6}{b^5}\)
2. \(\frac{b^5}{a^6}\)
3. \(\frac{a^2}{b}\)
4. \(a^{-2}b^{-1}\)

174 When \(x^{-1} - 1\) is divided by \(x - 1\), the quotient is

1. \(-1\)
2. \(-\frac{1}{x}\)
3. \(\frac{1}{x}\)
4. \(\frac{1}{(x - 1)^2}\)

175 Simplify the expression \(\frac{3x^{-4}y^5}{(2x^3y^{-7})^{-2}}\) and write the answer using only positive exponents.

176 When \(x^{-1} + 1\) is divided by \(x + 1\), the quotient equals

1. \(1\)
2. \(\frac{1}{x}\)
3. \(x\)
4. \(-\frac{1}{x}\)
177 Which expression is equivalent to $\frac{x^{-1}y^4}{3x^{-5}y^{-1}}$?

1. $\frac{x^4y^5}{3}$
2. $\frac{x^5y^4}{3}$
3. $3x^4y^5$
4. $\frac{y^4}{3x^5}$

178 Which expression is equivalent to $\frac{2x^{-2}y^{-2}}{4y^{-5}}$?

1. $\frac{y^3}{2x^2}$
2. $\frac{2y^3}{x^2}$
3. $\frac{2x^2}{y^3}$
4. $\frac{x^2}{2y^3}$

179 Which expression is equivalent to $(5^{-2}a^3b^{-4})^{-1}$?

1. $\frac{10b^4}{a^3}$
2. $\frac{25b^4}{a^3}$
3. $\frac{a^3}{25b^4}$
4. $\frac{a^2}{125b^5}$

180 Which expression is equivalent to $\frac{x^{-1}y^2}{x^{-2}y^{-4}}$?

1. $\frac{x}{y^2}$
2. $\frac{x^3}{y^6}$
3. $\frac{y^2}{x}$
4. $\frac{y^6}{x^3}$

A2.A.12: EVALUATING EXPONENTIAL EXPRESSIONS

181 Matt places $1,200 in an investment account earning an annual rate of 6.5%, compounded continuously. Using the formula $V = Pert$, where $V$ is the value of the account in $t$ years, $P$ is the principal initially invested, $e$ is the base of a natural logarithm, and $r$ is the rate of interest, determine the amount of money, to the nearest cent, that Matt will have in the account after 10 years.

182 Evaluate $e^{x\ln y}$ when $x = 3$ and $y = 2$.

183 The formula for continuously compounded interest is $A = Pe^{rt}$, where $A$ is the amount of money in the account, $P$ is the initial investment, $r$ is the interest rate, and $t$ is the time in years. Using the formula, determine, to the nearest dollar, the amount in the account after 8 years if $750 is invested at an annual rate of 3%.
184 If $5000 is invested at a rate of 3% interest compounded quarterly, what is the value of the investment in 5 years? (Use the formula
\[ A = P \left( 1 + \frac{r}{n} \right)^{nt} \], where \( A \) is the amount accrued, \( P \) is the principal, \( r \) is the interest rate, \( n \) is the number of times per year the money is compounded, and \( t \) is the length of time, in years.)
1 $5190.33
2 $5796.37
3 $5805.92
4 $5808.08

185 The formula to determine continuously compounded interest is \( A = Pe^{rt} \), where \( A \) is the amount of money in the account, \( P \) is the initial investment, \( r \) is the interest rate, and \( t \) is the time, in years. Which equation could be used to determine the value of an account with an $18,000 initial investment, at an interest rate of 1.25% for 24 months?
1 \( A = 18,000e^{1.25 \cdot 2} \)
2 \( A = 18,000e^{1.25 \cdot 24} \)
3 \( A = 18,000e^{0.0125 \cdot 2} \)
4 \( A = 18,000e^{0.0125 \cdot 24} \)

186 A population, \( p(x) \), of wild turkeys in a certain area is represented by the function \( p(x) = 17(1.15)^x \), where \( x \) is the number of years since 2010. How many more turkeys will be in the population for the year 2015 than 2010?
1 46
2 49
3 51
4 68

187 Yusef deposits $50 into a savings account that pays 3.25% interest compounded quarterly. The amount, \( A \), in his account can be determined by the formula \( A = P \left( 1 + \frac{r}{n} \right)^{nt} \), where \( P \) is the initial amount invested, \( r \) is the interest rate, \( n \) is the number of times per year the money is compounded, and \( t \) is the number of years for which the money is invested. What will his investment be worth in 12 years if he makes no other deposits or withdrawals?
1 $55.10
2 $73.73
3 $232.11
4 $619.74

188 The amount of money in an account can be determined by the formula \( A = Pe^{rt} \), where \( P \) is the initial investment, \( r \) is the annual interest rate, and \( t \) is the number of years the money was invested. What is the value of a $5000 investment after 18 years, if it was invested at 4% interest compounded continuously?
1 $9367.30
2 $9869.39
3 $10,129.08
4 $10,272.17

A2.A.18: EVALUATING LOGARITHMIC EXPRESSIONS

189 The expression \( \log_8 64 \) is equivalent to
1 8
2 2
3 \( \frac{1}{2} \)
4 \( \frac{1}{8} \)
190 The expression \( \log_5 \left( \frac{1}{25} \right) \) is equivalent to

1. \( \frac{1}{2} \)
2. 2
3. \( \frac{1}{2} \)
4. \(-2\)

**A2.A.53: GRAPHING EXPONENTIAL FUNCTIONS**

191 The graph of the equation \( y = \left( \frac{1}{2} \right)^x \) has an asymptote. On the grid below, sketch the graph of \( y = \left( \frac{1}{2} \right)^x \) and write the equation of this asymptote.

192 On the axes below, for \(-2 \leq x \leq 2\), graph \( y = 2^{x+1} - 3 \).
193 An investment is earning 5% interest compounded quarterly. The equation represents the total amount of money, \( A \), where \( P \) is the original investment, \( r \) is the interest rate, \( t \) is the number of years, and \( n \) represents the number of times per year the money earns interest. Which graph could represent this investment over at least 50 years?

194 If a function is defined by the equation \( f(x) = 4^x \), which graph represents the inverse of this function?
195 Which graph represents the function \( \log_2 x = y \)?

196 Which sketch shows the inverse of \( y = a^x \), where \( a > 1 \)?

**A2.A.19: PROPERTIES OF LOGARITHMS**

197 The expression \( 2 \log x - (3 \log y + \log z) \) is equivalent to

1. \( \log \frac{x^2}{y^3z} \)
2. \( \log \frac{x^2z}{y^3} \)
3. \( \log \frac{2x}{3yz} \)
4. \( \log \frac{2xz}{3y} \)
198 If \( r = \frac{\sqrt{A^2 B}}{C} \), then \( \log r \) can be represented by

1. \( \frac{1}{6} \log A + \frac{1}{3} \log B - \log C \)
2. \( 3(\log A + \log B - \log C) \)
3. \( \frac{1}{3} \log (A^2 + B) - C \)
4. \( \frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C \)

199 If \( \log x^2 = \log 2a = \log 3a \), then \( \log x \) expressed in terms of \( \log a \) is equivalent to

1. \( \frac{1}{2} \log 5a \)
2. \( \frac{1}{2} \log 6 + \log a \)
3. \( \log 6 + \log a \)
4. \( \log 6 + 2 \log a \)

200 If \( \log_b x = 3 \log_b 2 - \left( 2 \log_b t + \frac{1}{2} \log_b r \right) \), then the value of \( x \) is

1. \( \frac{p^3}{\sqrt{t^2r}} \)
2. \( p^3 \sqrt{\frac{1}{t^2}} \)
3. \( \frac{p^3}{t^2} \sqrt{r} \)
4. \( \frac{p^3}{t^2 \sqrt{r}} \)

201 If \( \log 2 = a \) and \( \log 3 = b \), the expression \( \log \frac{9}{20} \) is equivalent to

1. \( 2b - a + 1 \)
2. \( 2b - a - 1 \)
3. \( b^2 - a + 10 \)
4. \( \frac{2b}{a + 1} \)

202 The expression \( \log 4m^2 \) is equivalent to

1. \( 2(\log 4 + \log m) \)
2. \( 2 \log 4 + \log m \)
3. \( \log 4 + 2 \log m \)
4. \( \log 16 + 2 \log m \)

203 If \( 2x^3 = y \), then \( \log y \) equals

1. \( \log(2x) + \log 3 \)
2. \( 3 \log(2x) \)
3. \( 3 \log 2 + 3 \log x \)
4. \( \log 2 + 3 \log x \)

204 If \( \log x = 2 \log a + \log b \), then \( x \) equals

1. \( a^2 b \)
2. \( 2ab \)
3. \( a^2 + b \)
4. \( 2a + b \)

205 If \( T = \frac{10x^2}{y} \), then \( \log T \) is equivalent to

1. \( (1 + 2 \log x) - \log y \)
2. \( \log(1 + 2x) - \log y \)
3. \( (1 - 2 \log x) + \log y \)
4. \( 2(1 - \log x) + \log y \)

A2.A.28: LOGARITHMIC EQUATIONS

206 What is the solution of the equation \( 2 \log_4 (5x) = 3 \)?

1. \( 6.4 \)
2. \( 2.56 \)
3. \( 9 \)
4. \( \frac{8}{5} \)

207 Solve algebraically for \( x \): \( \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \)
208 The temperature, $T$, of a given cup of hot chocolate after it has been cooling for $t$ minutes can best be modeled by the function below, where $T_0$ is the temperature of the room and $k$ is a constant.

$$\ln(T - T_0) = -kt + 4.718$$

A cup of hot chocolate is placed in a room that has a temperature of 68°. After 3 minutes, the temperature of the hot chocolate is 150°. Compute the value of $k$ to the nearest thousandth. [Only an algebraic solution can receive full credit.] Using this value of $k$, find the temperature, $T$, of this cup of hot chocolate if it has been sitting in this room for a total of 10 minutes. Express your answer to the nearest degree. [Only an algebraic solution can receive full credit.]

209 What is the value of $x$ in the equation $\log_5 x = 4$?

1. 1.16
2. 20
3. 625
4. 1,024

210 If $\log_x 2 = 2.5$ and $\log_y 125 = -\frac{3}{2}$, find the numerical value of $\frac{x}{y}$ in simplest form.

211 Solve algebraically for all values of $x$:

$$\log_{(x+4)}(17x - 4) = 2$$

212 Solve algebraically for $x$:

$$\log_{27}(2x - 1) = \frac{4}{3}$$

213 Solve algebraically for all values of $x$:

$$\log_{(x+3)}(2x + 3) + \log_{(x+3)}(x + 5) = 2$$

214 Solve algebraically for $x$:

$$\log_{5x - 1} 4 = \frac{1}{3}$$

215 The equation $\log_a x = y$ where $x > 0$ and $a > 1$ is equivalent to

1. $x^y = a$
2. $y^a = x$
3. $a^y = x$
4. $a^x = y$

216 If $\log_{(x+1)} 64 = 3$, find the value of $x$.

217 Solve algebraically, to the nearest hundredth, for all values of $x$:

$$\log_3(x^2 - 7x + 12) - \log_3(2x - 10) = 3$$

218 Solve algebraically for the exact value of $x$:

$$\log_4 16 = x + 1$$

219 Akeem invests $25,000 in an account that pays 4.75% annual interest compounded continuously. Using the formula $A = Pe^{rt}$, where $A$ is the amount in the account after $t$ years, $P$ is principal invested, and $r$ is the annual interest rate, how many years, to the nearest tenth, will it take for Akeem’s investment to triple? (Round $e$ to three decimal places.)

1. 10.0
2. 14.6
3. 23.1
4. 24.0

220 A population of rabbits doubles every 60 days according to the formula $P = 10(2)^{\frac{t}{60}}$, where $P$ is the population of rabbits on day $t$. What is the value of $t$ when the population is 320?

1. 240
2. 300
3. 660
4. 960

221 The number of bacteria present in a Petri dish can be modeled by the function $N = 50e^{3t}$, where $N$ is the number of bacteria present in the Petri dish after $t$ hours. Using this model, determine, to the nearest hundredth, the number of hours it will take for $N$ to reach 30,700.
222 Susie invests $500 in an account that is compounded continuously at an annual interest rate of 5%, according to the formula $A = Pe^{rt}$, where $A$ is the amount accrued, $P$ is the principal, $r$ is the rate of interest, and $t$ is the time, in years. Approximately how many years will it take for Susie’s money to double?
1 1.4
2 6.0
3 13.9
4 14.7

223 The solution set of $4^{x^2 + 4x} = 2^{-6}$ is
1 \{1,3\}
2 \{-1,3\}
3 \{-1,-3\}
4 \{1,-3\}

224 What is the value of $x$ in the equation $9^{3x+1} = 27^{x+2}$?
1 1
2 $\frac{1}{3}$
3 $\frac{1}{2}$
4 $\frac{4}{3}$

225 Solve algebraically for $x$: $16^{2x+3} = 64^{x+2}$

226 The value of $x$ in the equation $4^{2x+5} = 8^{3x}$ is
1 1
2 2
3 5
4 -10

227 Solve algebraically for all values of $x$:
$81^{x^3 + 2x^2} = 27^{\frac{5x}{3}}$

228 Which value of $k$ satisfies the equation $8^{3k+4} = 4^{2k-1}$?
1 $-1$
2 $\frac{9}{4}$
3 $-2$
4 $\frac{14}{5}$

229 Solve $e^{4x} = 12$ algebraically for $x$, rounded to the nearest hundredth.

230 Solve algebraically for $x$: $5^{4x} = 125^{x-1}$

231 Solve for $x$: $\frac{1}{16} = 2^{3x-1}$

A2.A.36: BINOMIAL EXPANSIONS

232 What is the fourth term in the expansion of $(3x - 2)^5$?
1 $-720x^2$
2 $-240x$
3 $720x^2$
4 $1,080x^3$

233 Write the binomial expansion of $(2x - 1)^5$ as a polynomial in simplest form.

234 What is the coefficient of the fourth term in the expansion of $(a - 4b)^9$?
1 $-5,376$
2 $-336$
3 $336$
4 $5,376$

235 Which expression represents the third term in the expansion of $(2x^4 - y)^3$?
1 $-y^3$
2 $-6x^4y^2$
3 $6x^4y^2$
4 $2x^4y^2$
236 What is the middle term in the expansion of \(\left(\frac{x}{2} - 2y\right)^6\)?

1. \(20x^3y^3\)
2. \(-\frac{15}{4}x^4y^2\)
3. \(-20x^3y^3\)
4. \(\frac{15}{4}x^4y^2\)

237 What is the fourth term in the binomial expansion \((x - 2)^8\)?

1. \(448x^5\)
2. \(448x^4\)
3. \(-448x^5\)
4. \(-448x^4\)

238 What is the third term in the expansion of \((2x - 3)^5\)?

1. \(720x^3\)
2. \(180x^3\)
3. \(-540x^2\)
4. \(-1080x^2\)

239 The ninth term of the expansion of \((3x + 2y)^{15}\) is

1. \(\binom{15}{9}(3x)^6(2y)^9\)
2. \(\binom{15}{6}(3x)^9(2y)^6\)
3. \(\binom{15}{8}(3x)^7(2y)^8\)
4. \(\binom{15}{7}(3x)^8(2y)^7\)

240 Solve the equation \(8x^3 + 4x^2 - 18x - 9 = 0\) algebraically for all values of \(x\).

241 Which values of \(x\) are solutions of the equation \(x^3 + x^2 - 2x = 0\)?

1. \(0, 1, 2\)
2. \(0, 1, -2\)
3. \(0, -1, 2\)
4. \(0, -1, -2\)

242 What is the solution set of the equation \(3x^5 - 48x = 0\)?

1. \(\{0, \pm 2\}\)
2. \(\{0, \pm 2, 3\}\)
3. \(\{0, \pm 2, \pm 2i\}\)
4. \(\{\pm 2, \pm 2i\}\)

243 Solve algebraically for all values of \(x\):
\[x^4 + 4x^3 + 4x^2 = -16x\]

244 Solve \(x^3 + 5x^2 = 4x + 20\) algebraically.

245 Solve the equation \(2x^3 - x^2 - 8x + 4 = 0\) algebraically for all values of \(x\).

246 The graph of \(y = f(x)\) is shown below.

Which set lists all the real solutions of \(f(x) = 0\)?

1. \(\{-3, 2\}\)
2. \(\{-2, 3\}\)
3. \(\{-3, 0, 2\}\)
4. \(\{-2, 0, 3\}\)
247 The graph of \( y = x^3 - 4x^2 + x + 6 \) is shown below.

What is the product of the roots of the equation \( x^3 - 4x^2 + x + 6 = 0 \)?

1. \(-36\)
2. \(-6\)
3. \(6\)
4. \(4\)

248 How many negative solutions to the equation \( 2x^3 - 4x^2 + 3x - 1 = 0 \) exist?

1. \(1\)
2. \(2\)
3. \(3\)
4. \(0\)

249 What are the zeros of the polynomial function graphed below?

1. \([-3, -1, 2]\)
2. \([3, 1, -2]\)
3. \([4, -8]\)
4. \([-6]\)

### RADICALS

#### A2.N.4: OPERATIONS WITH IRRATIONAL EXPRESSIONS

250 The product of \((3 + \sqrt{5})\) and \((3 - \sqrt{5})\) is

1. \(4 - 6\sqrt{5}\)
2. \(14 - 6\sqrt{5}\)
3. \(14\)
4. \(4\)

#### A2.A.13: SIMPLIFYING RADICALS

251 Express in simplest form: \(\sqrt[3]{\frac{a^6 b^9}{-64}}\)

252 The expression \(\sqrt[3]{64a^{16}}\) is equivalent to

1. \(8a^4\)
2. \(8a^8\)
3. \(4a^5 \sqrt[3]{a}\)
4. \(4a^3 \sqrt[3]{a^5}\)
253 Express $5\sqrt{3x^3} - 2\sqrt{27x^3}$ in simplest radical form.

254 The sum of $\frac{3}{2}\sqrt{6a^4b^2}$ and $\frac{3}{4}\sqrt{162a^4b^2}$, expressed in simplest radical form, is

1. $\frac{3}{2}\sqrt{168a^8b^4}$
2. $2a^2b^2\sqrt{21a^2b}$
3. $4a^3\sqrt{6ab^2}$
4. $10a^2b^3\sqrt{8}$

255 The expression $\left(\frac{3}{2}\sqrt{27x^2}\right)\left(\frac{3}{4}\sqrt{16x^4}\right)$ is equivalent to

1. $12x^2\sqrt{2}$
2. $12x^2\sqrt{2}$
3. $6x^3\sqrt{2x^2}$
4. $6x^3\sqrt{2}$

256 What is the product of $\frac{3}{2}\sqrt{4a^2b^4}$ and $\frac{3}{4}\sqrt{16a^4b^2}$?

1. $4ab^2\sqrt{a^2}$
2. $4a^2b^3\sqrt{a}$
3. $8ab^2\sqrt{a^2}$
4. $8a^2b^3\sqrt{a}$

257 The expression $4ab\sqrt{2b} - 3a\sqrt{18b^3} + 7ab\sqrt{6b}$ is equivalent to

1. $2ab\sqrt{6b}$
2. $16ab\sqrt{2b}$
3. $-5ab + 7ab\sqrt{6b}$
4. $-5ab\sqrt{2b} + 7ab\sqrt{6b}$

258 Express $\frac{\sqrt{108x^5y^8}}{\sqrt{6xy^5}}$ in simplest radical form.

259 The expression $\left(2 - 3\sqrt{x}\right)^2$ is equivalent to

1. $4 - 9x$
2. $4 - 3x$
3. $4 - 12\sqrt{x} + 9x$
4. $4 - 12\sqrt{x} + 6x$

260 The expression $\frac{3}{4}\sqrt{27a^3} \cdot \frac{1}{4}\sqrt{16b^8}$ is equivalent to

1. $6ab^2$
2. $6ab^4$
3. $12ab^3$
4. $12ab^4$

261 The legs of a right triangle are represented by $x + \sqrt{2}$ and $x - \sqrt{2}$. The length of the hypotenuse of the right triangle is represented by

1. $\sqrt{2x^2 + 4}$
2. $2x^2 + 4$
3. $\sqrt{x^2 + 2}$
4. $\sqrt{x^2 - 2}$

262 Express $\frac{5}{3 - \sqrt{2}}$ with a rational denominator, in simplest radical form.

263 Which expression is equivalent to $\frac{\sqrt{3} + 5}{\sqrt{3} - 5}$?

1. $\frac{14 + 5\sqrt{3}}{11}$
2. $\frac{17 + 5\sqrt{3}}{11}$
3. $\frac{14 + 5\sqrt{3}}{14}$
4. $\frac{17 + 5\sqrt{3}}{14}$
264. The expression $\frac{4}{5 - \sqrt{13}}$ is equivalent to

1. $\frac{4\sqrt{13}}{5\sqrt{13} - 13}$
2. $\frac{4(5 - \sqrt{13})}{38}$
3. $\frac{5 + \sqrt{13}}{3}$
4. $\frac{4(5 + \sqrt{13})}{38}$

265. The expression $\frac{1}{7 - \sqrt{11}}$ is equivalent to

1. $\frac{7 + \sqrt{11}}{38}$
2. $\frac{7 - \sqrt{11}}{38}$
3. $\frac{7 + \sqrt{11}}{60}$
4. $\frac{7 - \sqrt{11}}{60}$

266. The expression $\frac{5}{4 - \sqrt{11}}$ is equivalent to

1. $4 + \sqrt{11}$
2. $\frac{20 + 5\sqrt{11}}{27}$
3. $4 - \sqrt{11}$
4. $\frac{20 - 5\sqrt{11}}{27}$

267. The expression $\frac{3 - \sqrt{8}}{\sqrt{3}}$ is equivalent to

1. $\frac{\sqrt{3} - 2\sqrt{6}}{\sqrt{3}}$
2. $-\sqrt{3} + \frac{2}{3}\sqrt{6}$
3. $\frac{3 - \sqrt{24}}{3}$
4. $\frac{\sqrt{3} - \frac{2}{3}\sqrt{6}}{3}$

268. The fraction $\frac{3}{\sqrt{3a^2b}}$ is equivalent to

1. $\frac{1}{a\sqrt{b}}$
2. $\frac{\sqrt{b}}{ab}$
3. $\frac{3\sqrt{b}}{ab}$
4. $\frac{\sqrt{3}}{a}$

269. The expression $\frac{2x + 4}{\sqrt{x} + 2}$ is equivalent to

1. $\frac{(2x + 4)\sqrt{x} - 2}{x - 2}$
2. $\frac{(2x + 4)(\sqrt{x} - 2)}{x - 4}$
3. $2\sqrt{x} - 2$
4. $2\sqrt{x} + 2$
270 Expressed with a rational denominator and in simplest form, \( \frac{x}{x - \sqrt{x}} \) is
1 \( \frac{x^2 + x\sqrt{x}}{x^2 - x} \)
2 \( -\sqrt{x} \)
3 \( \frac{x + \sqrt{x}}{1 - x} \)
4 \( \frac{x + \sqrt{x}}{x - 1} \)

A2.A.22: SOLVING RADICALS

271 The solution set of the equation \( \sqrt{x + 3} = 3 - x \) is
1 \{1\}
2 \{0\}
3 \{1, 6\}
4 \{2, 3\}

272 The solution set of \( \sqrt{3x + 16} = x + 2 \) is
1 \{-3, 4\}
2 \{-4, 3\}
3 \{3\}
4 \{-4\}

273 Solve algebraically for \( x \): \( 4 - \sqrt{2x - 5} = 1 \)

274 What is the solution set for the equation \( \sqrt{5x + 29} = x + 3 \)?
1 \{4\}
2 \{-5\}
3 \{4, 5\}
4 \{-5, 4\}

275 Solve algebraically for \( x \):
\( \sqrt{x^2 + x - 1 + 11x} = 7x + 3 \)

276 The solution set of the equation \( \sqrt{2x - 4} = x - 2 \) is
1 \{-2, -4\}
2 \{2, 4\}
3 \{4\}
4 \{\} 

277 Solve algebraically for \( x \): \( \sqrt{2x + 1} + 4 = 8 \)

A2.A.10-11: EXPONENTS AS RADICALS

278 The expression \( (x^2 - 1)^{\frac{2}{3}} \) is equivalent to
1 \( \frac{2}{3} (x^2 - 1)^{\frac{2}{3}} \)
2 \( \frac{1}{\sqrt[3]{(x^2 - 1)^{\frac{2}{3}}}} \)
3 \( \sqrt[3]{(x^2 - 1)^{\frac{2}{3}}} \)
4 \( \sqrt[3]{(x^2 - 1)^{\frac{2}{3}}} \)

279 The expression \( x^{-\frac{2}{5}} \) is equivalent to
1 \( -\frac{1}{\sqrt[5]{x^2}} \)
2 \( \sqrt[5]{x^2} \)
3 \( \frac{1}{\sqrt[5]{x^2}} \)
4 \( \frac{1}{\sqrt[5]{x^2}} \)

280 The expression \( \sqrt[4]{16x^2y^7} \) is equivalent to
1 \( 2x^{\frac{1}{4}}y^{\frac{3}{4}} \)
2 \( 2x^{\frac{1}{2}}y^{\frac{7}{4}} \)
3 \( 4x^{\frac{1}{4}}y^{\frac{7}{4}} \)
4 \( 4x^{\frac{1}{2}}y^{\frac{7}{4}} \)

281 The expression \( \sqrt[5]{81x^2y^5} \) is equivalent to
1 \( 3x^{\frac{2}{5}}y^{\frac{5}{2}} \)
2 \( 3x^{\frac{4}{5}}y^{\frac{5}{2}} \)
3 \( 9xy^{\frac{5}{2}} \)
4 \( 9xy^{\frac{5}{2}} \)
282 The expression \( \sqrt[3]{27a^6b^3c^2} \) is equivalent to

1. \( \frac{3}{2} \)
2. \( \frac{3bc}{a^2} \)
3. \( \frac{3b^9c^6}{a^{18}} \)
4. \( \frac{3b^6c^5}{a^3} \)
5. \( \frac{3b^3\sqrt{3c^2}}{a^2} \)

**A2.N.6: SQUARE ROOTS OF NEGATIVE NUMBERS**

283 In simplest form, \( \sqrt{-300} \) is equivalent to

1. \( 3i\sqrt{10} \)
2. \( -5i\sqrt{12} \)
3. \( 10i\sqrt{3} \)
4. \( 12i\sqrt{5} \)

284 Expressed in simplest form, \( \sqrt{-18} - \sqrt{-32} \) is

1. \( -\sqrt{2} \)
2. \( -7\sqrt{2} \)
3. \( -i\sqrt{2} \)
4. \( 7i\sqrt{2} \)

285 The expression \( \sqrt{-180x^{16}} \) is equivalent to

1. \( -6x^4\sqrt{5} \)
2. \( -6x^8\sqrt{5} \)
3. \( 6x^4i\sqrt{5} \)
4. \( 6x^8i\sqrt{5} \)

**A2.N.7: IMAGINARY NUMBERS**

286 The product of \( i^7 \) and \( i^8 \) is equivalent to

1. \( 1 \)
2. \( -1 \)
3. \( i \)
4. \( -i \)

287 The expression \( 2i^2 + 3i^3 \) is equivalent to

1. \( -2 - 3i \)
2. \( 2 - 3i \)
3. \( -2 + 3i \)
4. \( 2 + 3i \)

288 Determine the value of \( n \) in simplest form:

\[ i^{13} + i^{18} + i^{31} + n = 0 \]

289 Express \( 4xi + 5yi^8 + 6xi^3 + 2yi^4 \) in simplest \( a + bi \) form.

290 Express \( xi^8 - yi^6 \) in simplest form.

291 The expression \( x(3i^2)^3 + 2xi^{12} \) is equivalent to

1. \( 2x + 27xi \)
2. \( -7x \)
3. \( -25x \)
4. \( -29x \)

**A2.N.8: CONJUGATES OF COMPLEX NUMBERS**

292 What is the conjugate of \( -2 + 3i \)?

1. \( -3 + 2i \)
2. \( -2 - 3i \)
3. \( 2 - 3i \)
4. \( 3 + 2i \)

293 The conjugate of \( 7 - 5i \) is

1. \( -7 - 5i \)
2. \( -7 + 5i \)
3. \( 7 - 5i \)
4. \( 7 + 5i \)

294 What is the conjugate of \( \frac{1}{2} + \frac{3}{2}i \)?

1. \( \frac{1}{2} + \frac{3}{2}i \)
2. \( \frac{1}{2} - \frac{3}{2}i \)
3. \( \frac{3}{2} + \frac{1}{2}i \)
4. \( \frac{1}{2} - \frac{3}{2}i \)
295 The conjugate of the complex expression \(-5x + 4i\) is
1. \(5x - 4i\)
2. \(5x + 4i\)
3. \(-5x - 4i\)
4. \(-5x + 4i\)

A2.N.9: MULTIPLICATION AND DIVISION OF COMPLEX NUMBERS

296 The expression \((3 - 7i)^2\) is equivalent to
1. \(-40 + 0i\)
2. \(-40 - 42i\)
3. \(58 + 0i\)
4. \(58 - 42i\)

297 The expression \((x + i)^2 - (x - i)^2\) is equivalent to
1. \(0\)
2. \(-2\)
3. \(-2 + 4xi\)
4. \(4xi\)

298 If \(x = 3i\), \(y = 2i\), and \(z = m + i\), the expression \(xy^2z\) equals
1. \(-12 - 12mi\)
2. \(-6 - 6mi\)
3. \(12 - 12mi\)
4. \(6 - 6mi\)

299 Multiply \(x + yi\) by its conjugate, and express the product in simplest form.

300 When \(-3 - 2i\) is multiplied by its conjugate, the result is
1. \(-13\)
2. \(-5\)
3. \(5\)
4. \(13\)

301 If \(x\) is a real number, express \(2xi(4i^2)\) in simplest \(a + bi\) form.

RATIONALS
A2.A.16: MULTIPLICATION AND DIVISION OF RATIONALS

302 Perform the indicated operations and simplify completely:
\[
\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2}
\]

303 The expression \(\frac{x^2 + 9x - 22}{x^2 - 121} + (2 - x)\) is equivalent to
1. \(x - 11\)
2. \(\frac{1}{x - 11}\)
3. \(11 - x\)
4. \(\frac{1}{11 - x}\)

A2.A.16: ADDITION AND SUBTRACTION OF RATIONALS

304 Expressed in simplest form, \(\frac{3y}{2y - 6} + \frac{9}{6 - 2y}\) is equivalent to
1. \(-6y^2 + 36y - 54\)
2. \(\frac{3y - 9}{2y - 6}\)
3. \(\frac{3}{2}\)
4. \(\frac{3}{2}\)
305 What is \( \frac{x}{x-1} - \frac{1}{2-2x} \) expressed as a single fraction?

1. \( \frac{x+1}{x-1} \)
2. \( \frac{2x-1}{2-2x} \)
3. \( \frac{2x+1}{2(x-1)} \)
4. \( \frac{2x-1}{2(x-1)} \)

A2.A.23: SOLVING RATIONALS AND RATIONAL INEQUALITIES

306 Solve for \( x \): \( \frac{4x}{x-3} = 2 + \frac{12}{x-3} \)

307 Solve algebraically for \( x \): \( \frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2 - 9} \)

308 Solve the equation below algebraically, and express the result in simplest radical form:

\( \frac{13}{x} = 10 - x \)

309 What is the solution set of the equation

\( \frac{30}{x^2 - 9} + 1 = \frac{5}{x-3} \) ?

1. \{2, 3\}
2. \{2\}
3. \{3\}
4. \{ \}

310 Which equation could be used to solve \( \frac{5}{x-3} - \frac{2}{x} = 1 \)?

1. \( x^2 - 6x - 3 = 0 \)
2. \( x^2 - 6x + 3 = 0 \)
3. \( x^2 - 6x - 6 = 0 \)
4. \( x^2 - 6x + 6 = 0 \)

311 Solve algebraically for \( x \):

\( \frac{3}{x} + \frac{x}{x+2} = \frac{2}{x+2} \)

312 Solve algebraically for the exact values of \( x \):

\( \frac{5x}{2} = \frac{1}{x} + \frac{x}{4} \)

313 Which graph represents the solution set of

\( \frac{x+16}{x-2} \leq 7 \) ?

A2.A.17: COMPLEX FRACTIONS

314 Written in simplest form, the expression \( \frac{x}{4} - \frac{1}{x} \) is equivalent to

1. \( \frac{x - 1}{2} \)
2. \( \frac{x - 2}{2} \)
3. \( \frac{x - 2}{2} \)
4. \( \frac{x^2 - 4}{x + 2} \)

315 Express in simplest form:

\( \frac{1}{2} \cdot \frac{4}{d} \)

316 Express in simplest form:

\( \frac{4-x^2}{x^2 + 7x + 12} \)

\( \frac{2x-4}{x+3} \)
317 The simplest form of \( \frac{\frac{1}{x} - \frac{4}{x}}{\frac{2}{x} - \frac{8}{x^2}} \) is

1. \( \frac{1}{2} \)
2. \( \frac{x}{x+2} \)
3. \( \frac{x}{3} \)
4. \( \frac{-x}{x-2} \)

318 The expression \( \frac{a + b}{c} \) is equivalent to \( \frac{d}{b} - \frac{c}{d} \)

1. \( \frac{c + 1}{d - 1} \)
2. \( \frac{a + b}{d - b} \)
3. \( \frac{ac + b}{cd - b} \)
4. \( \frac{ac + 1}{cd - 1} \)

319 Express in simplest terms:
\[
\frac{1 + \frac{3}{x}}{\frac{5}{x} - \frac{24}{x^2}}
\]

320 Express in simplest form:
\[
\frac{\frac{36 - x^2}{(x+6)^2}}{\frac{x-3}{x^2 + 3x - 18}}
\]

321 The expression \( \frac{1}{x} + \frac{3}{y} \) is equivalent to

1. \( \frac{3}{2} \)
2. \( \frac{3x + y}{2xy} \)
3. \( \frac{3xy}{2} \)
4. \( \frac{3x + y}{2} \)

A2.A.5: INVERSE VARIATION

322 For a given set of rectangles, the length is inversely proportional to the width. In one of these rectangles, the length is 12 and the width is 6. For this set of rectangles, calculate the width of a rectangle whose length is 9.

323 If \( p \) varies inversely as \( q \), and \( p = 10 \) when \( q = \frac{3}{2} \), what is the value of \( p \) when \( q = \frac{3}{5} \)?

1. 25
2. 15
3. 9
4. 4

324 The quantities \( p \) and \( q \) vary inversely. If \( p = 20 \) when \( q = -2 \), and \( p = x \) when \( q = -2x + 2 \), then \( x \) equals

1. -4 and 5
2. \( \frac{20}{19} \)
3. -5 and 4
4. \( \frac{1}{4} \)
325 The points (2, 3), \(4, \frac{3}{4}\), and (6, \(d\)) lie on the graph of a function. If \(y\) is inversely proportional to the square of \(x\), what is the value of \(d\)?

1 1 
2 \(\frac{1}{3}\) 
3 3 
4 27

326 If \(d\) varies inversely as \(t\), and \(d = 20\) when \(t = 2\), what is the value of \(t\) when \(d = -5\)?

1 8 
2 2 
3 -8 
4 -2

327 If \(p\) and \(q\) vary inversely and \(p = 25\) when \(q = 6\), determine \(q\) when \(p\) is equal to 30.

328 Given \(y\) varies inversely as \(x\), when \(y\) is multiplied by \(\frac{1}{2}\), then \(x\) is multiplied by

1 \(\frac{1}{2}\) 
2 2 
3 \(-\frac{1}{2}\) 
4 -2

329 A scholarship committee rewards the school's top math students. The amount of money each winner receives is inversely proportional to the number of scholarship recipients. If there are three winners, they each receive $400. If there are eight winners, how much money will each winner receive?

1 $1067 
2 $400 
3 $240 
4 $150

330 The equation \(y - 2\sin \theta = 3\) may be rewritten as

1 \(f(y) = 2 \sin x + 3\) 
2 \(f(y) = 2 \sin \theta + 3\) 
3 \(f(x) = 2 \sin \theta + 3\) 
4 \(f(\theta) = 2 \sin \theta + 3\)

331 If \(f(x) = \frac{x}{x^2 - 16}\), what is the value of \(f(-10)\)?

1 \(-\frac{5}{2}\) 
2 \(-\frac{5}{42}\) 
3 \(-\frac{5}{58}\) 
4 \(-\frac{5}{18}\)

332 If \(g(x) = \left(ax \sqrt{1-x}\right)^2\), express \(g(10)\) in simplest form.

333 If \(f(x) = 4x^2 - x + 1\), then \(f(a + 1)\) equals

1 \(4a^2 - a + 6\) 
2 \(4a^2 - a + 4\) 
3 \(4a^2 + 7a + 6\) 
4 \(4a^2 + 7a + 4\)

334 If \(f(x) = 2x^3 - 3x + 4\), then \(f(x + 3)\) is equal to

1 \(2x^3 - 3x + 7\) 
2 \(2x^3 - 3x + 13\) 
3 \(2x^3 + 9x + 13\) 
4 \(2x^3 + 9x + 25\)
335. On January 1, a share of a certain stock cost $180. Each month thereafter, the cost of a share of this stock decreased by one-third. If $x$ represents the time, in months, and $y$ represents the cost of the stock, in dollars, which graph best represents the cost of a share over the following 5 months?

A2.A.52: FAMILIES OF FUNCTIONS

336. Which statement about the graph of the equation $y = e^x$ is not true?
1. It is asymptotic to the $x$-axis.
2. The domain is the set of all real numbers.
3. It lies in Quadrants I and II.
4. It passes through the point $(e, 1)$.

A2.A.52: PROPERTIES OF GRAPHS OF FUNCTIONS AND RELATIONS

337. Theresa is comparing the graphs of $y = 2^x$ and $y = 5^x$. Which statement is true?
1. The $y$-intercept of $y = 2^x$ is $(0, 2)$, and the $y$-intercept of $y = 5^x$ is $(0, 5)$.
2. Both graphs have a $y$-intercept of $(0, 1)$, and $y = 2^x$ is steeper for $x > 0$.
3. Both graphs have a $y$-intercept of $(0, 1)$, and $y = 5^x$ is steeper for $x > 0$.
4. Neither graph has a $y$-intercept.

A2.A.52: IDENTIFYING THE EQUATION OF A GRAPH

338. Four points on the graph of the function $f(x)$ are shown below.
$\{(0,1),(1,2),(2,4),(3,8)\}$
Which equation represents $f(x)$?
1. $f(x) = 2^x$
2. $f(x) = 2x$
3. $f(x) = x + 1$
4. $f(x) = \log_2 x$
339 Which equation is represented by the graph below?

![Graph](image)

1. \( y = 5^x \)
2. \( y = 0.5^x \)
3. \( y = 5^{-x} \)
4. \( y = 0.5^{-x} \)

340 What is the equation of the graph shown below?

![Graph](image)

1. \( y = 2^x \)
2. \( y = 2^{-x} \)
3. \( x = 2^y \)
4. \( x = 2^{-y} \)

341 The table of values below can be modeled by which equation?

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>-1</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

1. \( f(x) = |x + 3| \)
2. \( f(x) = |x| + 3 \)
3. \( f(y) = |y + 3| \)
4. \( f(y) = |y| + 3 \)

**A2.A.37, 38, 43: DEFINING FUNCTIONS**

342 Given the relation \{(8,2),(3,6),(7,5),(k, 4)\}, which value of \( k \) will result in the relation *not* being a function?

1. 1
2. 2
3. 3
4. 4
343 Which graph does not represent a function?

344 Which relation is not a function?

1. \((x - 2)^2 + y^2 = 4\)
2. \(x^2 + 4x + y = 4\)
3. \(x + y = 4\)
4. \(xy = 4\)
346 Which graph represents a relation that is not a function?

347 Which graph represents a function?
348 Which statement is true about the graphs of \(f\) and \(g\) shown below?

1. \(f\) is a relation and \(g\) is a function.
2. \(f\) is a function and \(g\) is a relation.
3. Both \(f\) and \(g\) are functions.
4. Neither \(f\) nor \(g\) is a function.

349 Which relation does \textit{not} represent a function?

1. \[
\begin{array}{c}
3 \\
5 \\
7 \\
\end{array} 
\xrightarrow{f} 
\begin{array}{c}
4 \\
6 \\
8 \\
\end{array}
\]

2. \[
\begin{array}{c}
3 \\
5 \\
7 \\
\end{array} 
\xrightarrow{g} 
\begin{array}{c}
4 \\
6 \\
8 \\
\end{array}
\]

3. \[
\begin{array}{c}
3 \\
5 \\
7 \\
\end{array} 
\xrightarrow{h} 
\begin{array}{c}
4 \\
6 \\
8 \\
\end{array}
\]

4. \[
\begin{array}{c}
3 \\
5 \\
7 \\
\end{array} 
\xrightarrow{i} 
\begin{array}{c}
4 \\
6 \\
8 \\
\end{array}
\]

350 Which function is \textit{not} one-to-one?

1. \{(0,1),(1,2),(2,3),(3,4)\}
2. \{(0,0),(1,1),(2,2),(3,3)\}
3. \{(0,1),(1,0),(2,3),(3,2)\}
4. \{(0,1),(1,0),(2,0),(3,2)\}
351 Which graph represents a one-to-one function?

1
2
3
4

352 Which function is one-to-one?
1 \( f(x) = |x| \)
2 \( f(x) = 2^x \)
3 \( f(x) = x^2 \)
4 \( f(x) = \sin(x) \)

353 Which function is one-to-one?
1 \( k(x) = x^2 + 2 \)
2 \( g(x) = x^3 + 2 \)
3 \( f(x) = |x| + 2 \)
4 \( j(x) = x^4 + 2 \)

354 Which diagram represents a relation that is both one-to-one and onto?

1
2
3
4

355 Which relation is both one-to-one and onto?

1
2
3
4
356 Which list of ordered pairs does not represent a one-to-one function?
1 (1,−1),(2,0),(3,1),(4,2)
2 (1,2),(2,3),(3,4),(4,6)
3 (1,3),(2,4),(3,3),(4,1)
4 (1,5),(2,4),(3,1),(4,0)

A2.A.39, 51: DOMAIN AND RANGE

357 What is the domain of the function \( f(x) = \sqrt{x - 2} + 3 \)?
1 \((-\infty, \infty)\)
2 \((2, \infty)\)
3 \([2, \infty)\)
4 \([3, \infty)\)

358 What is the range of \( f(x) = (x + 4)^2 + 7 \)?
1 \(y \geq -4\)
2 \(y \geq 4\)
3 \(y = 7\)
4 \(y \geq 7\)

359 What is the range of \( f(x) = |x - 3| + 2 \)?
1 \(\{x \mid x \geq 3\}\)
2 \(\{y \mid y \geq 2\}\)
3 \(\{x \mid x \in \text{real numbers}\}\)
4 \(\{y \mid y \in \text{real numbers}\}\)

360 If \( f(x) = \sqrt{9 - x^2} \), what are its domain and range?
1 domain: \(\{x \mid -3 \leq x \leq 3\}\); range: \(\{y \mid 0 \leq y \leq 3\}\)
2 domain: \(\{x \mid x \neq \pm 3\}\); range: \(\{y \mid 0 \leq y \leq 3\}\)
3 domain: \(\{x \mid x \leq -3 \text{ or } x \geq 3\}\); range: \(\{y \mid y \neq 0\}\)
4 domain: \(\{x \mid x \neq 3\}\); range: \(\{y \mid y \geq 0\}\)

361 For \( y = \frac{3}{\sqrt{x - 4}} \), what are the domain and range?
1 \(\{x \mid x > 4\} \text{ and } \{y \mid y > 0\}\)
2 \(\{x \mid x \geq 4\} \text{ and } \{y \mid y > 0\}\)
3 \(\{x \mid x > 4\} \text{ and } \{y \mid y \geq 0\}\)
4 \(\{x \mid x \geq 4\} \text{ and } \{y \mid y \geq 0\}\)

362 The domain of \( f(x) = \frac{3}{\sqrt{2 - x}} \) is the set of all real numbers
1 greater than 2
2 less than 2
3 except 2
4 between −2 and 2

363 What is the domain of the function \( g(x) = 3^x - 1 \)?
1 \((-\infty, 3]\)
2 \((-\infty, 3)\)
3 \((-\infty, \infty)\)
4 \((-1, \infty)\)

364 What are the domain and the range of the function shown in the graph below?

\[\text{Graph}\]
365 The graph below represents the function \( y = f(x) \).

State the domain and range of this function.

366 What is the domain of the function shown below?

\[
\begin{align*}
1 & \quad x \leq 0 \\
2 & \quad x \geq 0 \\
3 & \quad y \leq 0 \\
4 & \quad y \geq 0
\end{align*}
\]

367 What is the range of the function shown below?

368 The graph below shows the average price of gasoline, in dollars, for the years 1997 to 2007.

What is the approximate range of this graph?

\[
\begin{align*}
1 & \quad 1997 \leq x \leq 2007 \\
2 & \quad 1999 \leq x \leq 2007 \\
3 & \quad 0.97 \leq y \leq 2.38 \\
4 & \quad 1.27 \leq y \leq 2.38
\end{align*}
\]
369 Which value is in the domain of the function graphed below, but is not in its range?

![Graph](image)

1 0
2 2
3 3
4 7

**A2.A.42: COMPOSITIONS OF FUNCTIONS**

370 If \( f(x) = \frac{1}{2}x - 3 \) and \( g(x) = 2x + 5 \), what is the value of \( (g \circ f)(4) \)?

1 -13
2 3.5
3 3
4 6

371 If \( f(x) = x^2 - 5 \) and \( g(x) = 6x \), then \( g(f(x)) \) is equal to

1 \( 6x^3 - 30x \)
2 \( 6x^2 - 30 \)
3 \( 36x^2 - 5 \)
4 \( x^2 + 6x - 5 \)

372 If \( f(x) = x^2 - 6 \) and \( g(x) = 2x - 1 \), determine the value of \( (g \circ f)(-3) \).

373 If \( f(x) = 4x - x^2 \) and \( g(x) = \frac{1}{x} \), then \( (f \circ g)(\frac{1}{2}) \) is equal to

1 \( \frac{4}{7} \)
2 \(-2 \)
3 \( \frac{7}{2} \)
4 \( 4 \)

374 Which expression is equivalent to \( (n \circ m \circ p)(x) \), given \( m(x) = \sin x \), \( n(x) = 3x \), and \( p(x) = x^2 \)?

1 \( \sin(3x)^2 \)
2 \( 3\sin^2 x \)
3 \( \sin^3(3x) \)
4 \( 3\sin^2 x \)

375 If \( g(x) = \frac{1}{2}x + 8 \) and \( h(x) = \frac{1}{2}x - 2 \), what is the value of \( g(h(-8)) \)?

1 0
2 9
3 5
4 4

376 If \( f(x) = 2x^2 - 3x + 1 \) and \( g(x) = x + 5 \), what is \( f(g(x)) \)?

1 \( 2x^2 + 17x + 36 \)
2 \( 2x^2 + 17x + 66 \)
3 \( 2x^2 - 3x + 6 \)
4 \( 2x^2 - 3x + 36 \)

377 If \( f(x) = 2x^2 + 1 \) and \( g(x) = 3x - 2 \), what is the value of \( f(g(-2)) \)?

1 \(-127 \)
2 \(-23 \)
3 \( 25 \)
4 \( 129 \)

378 If \( f(x) = x^2 - x \) and \( g(x) = x + 1 \), determine \( f(g(x)) \) in simplest form.
A2.A.44: INVERSE OF FUNCTIONS

379 Which two functions are inverse functions of each other?
1 \( f(x) = \sin x \) and \( g(x) = \cos x \)
2 \( f(x) = 3 + 8x \) and \( g(x) = 3 - 8x \)
3 \( f(x) = e^x \) and \( g(x) = \ln x \)
4 \( f(x) = 2x - 4 \) and \( g(x) = -\frac{1}{2} x + 4 \)

380 If \( f(x) = x^2 - 6 \), find \( f^{-1}(x) \).

381 What is the inverse of the function \( f(x) = \log_4 x \)?
1 \( f^{-1}(x) = x^4 \)
2 \( f^{-1}(x) = 4^x \)
3 \( f^{-1}(x) = \log_4 4 \)
4 \( f^{-1}(x) = -\log_4 4 \)

382 If \( m = \{(-1, 1), (1, 1), (-2, 4), (2, 4), (-3, 9), (3, 9)\} \), which statement is true?
1 \( m \) and its inverse are both functions.
2 \( m \) is a function and its inverse is not a function.
3 \( m \) is not a function and its inverse is a function.
4 Neither \( m \) nor its inverse is a function.

A2.A.46: TRANSFORMATIONS WITH FUNCTIONS AND RELATIONS

383 The graph below shows the function \( f(x) \).

Which graph represents the function \( f(x + 2) \)?
384 The minimum point on the graph of the equation \( y = f(x) \) is \((-1, -3)\). What is the minimum point on the graph of the equation \( y = f(x) + 5 \)?

1. \((-1, 2)\)
2. \((-1, -8)\)
3. \((4, -3)\)
4. \((-6, -3)\)

385 The function \( f(x) \) is graphed on the set of axes below. On the same set of axes, graph \( f(x + 1) + 2 \).

386 Which transformation of \( y = f(x) \) moves the graph 7 units to the left and 3 units down?

1. \( y = f(x + 7) - 3 \)
2. \( y = f(x + 7) + 3 \)
3. \( y = f(x - 7) - 3 \)
4. \( y = f(x - 7) + 3 \)

387 What is the formula for the \( n \)th term of the sequence 54, 18, 6, \ldots?

1. \( a_n = 6 \left( \frac{1}{3} \right)^n \)
2. \( a_n = 6 \left( \frac{1}{3} \right)^{n-1} \)
3. \( a_n = 54 \left( \frac{1}{3} \right)^n \)
4. \( a_n = 54 \left( \frac{1}{3} \right)^{n-1} \)

388 What is a formula for the \( n \)th term of sequence \( B \) shown below?

\( B = 10, 12, 14, 16, \ldots \)

1. \( b_n = 8 + 2n \)
2. \( b_n = 10 + 2n \)
3. \( b_n = 10(2)^n \)
4. \( b_n = 10(2)^{n-1} \)

389 A sequence has the following terms: \( a_1 = 4 \), \( a_2 = 10 \), \( a_3 = 25 \), \( a_4 = 62.5 \). Which formula represents the \( n \)th term in the sequence?

1. \( a_n = 4 + 2.5n \)
2. \( a_n = 4 + 2.5(n - 1) \)
3. \( a_n = 4(2.5)^n \)
4. \( a_n = 4(2.5)^{n-1} \)

390 In an arithmetic sequence, \( a_4 = 19 \) and \( a_7 = 31 \). Determine a formula for \( a_n \), the \( n \)th term of this sequence.

391 A theater has 35 seats in the first row. Each row has four more seats than the row before it. Which expression represents the number of seats in the \( n \)th row?

1. \( 35 + (n + 4) \)
2. \( 35 + (4n) \)
3. \( 35 + (n + 1)(4) \)
4. \( 35 + (n - 1)(4) \)
392 What is the common difference of the arithmetic sequence 5, 8, 11, 14?
1 8
2 5
3 −3
4 9

393 Which arithmetic sequence has a common difference of 4?
1 {0, 4n, 8n, 12n, . . .}
2 {n, 4n, 16n, 64n, . . .}
3 {n + 1, n + 5, n + 9, n + 13, . . .}
4 {n + 4, n + 16, n + 64, n + 256, . . .}

394 What is the common difference in the sequence 2a + 1, 4a + 4, 6a + 7, 8a + 10, . . .?
1 2a + 3
2 −2a − 3
3 2a + 5
4 −2a + 5

395 What is the common difference of the arithmetic sequence below?
−7x, −4x, −x, 2x, 5x, . . .
1 −3
2 −3x
3 3
4 3x

396 Given the sequence: x, (x + y), (x + 2y), . . .
Which expression can be used to determine the common difference of this sequence?
1 x − (x + y)
2 (x + 2y) − (x + y)
3 \[ \frac{x}{x + y} \]
4 \[ \frac{(x + 2y)}{(x + y)} \]

397 What is the common ratio of the geometric sequence whose first term is 27 and fourth term is 64?
1 \[ \frac{3}{4} \]
2 64
3 \[ \frac{4}{3} \]
4 \[ \frac{37}{3} \]

398 What is the common ratio of the geometric sequence shown below? −2, 4, −8, 16, . . .
1 \[ \frac{1}{2} \]
2 2
3 −2
4 −6

399 What is the common ratio of the sequence \[ \frac{1}{64} a^5 b^3, \frac{3}{32} a^3 b^4, \frac{9}{16} a b^5, . . . \]?
1 \[ \frac{3b}{2a^2} \]
2 \[ \frac{6b}{a^2} \]
3 \[ \frac{3a^2}{b} \]
4 \[ \frac{6a^2}{b} \]

400 The common ratio of the sequence \[ \frac{1}{2}, \frac{3}{4}, \frac{9}{8} \] is
1 \[ \frac{3}{2} \]
2 \[ \frac{2}{3} \]
3 \[ \frac{1}{2} \]
4 \[ \frac{1}{4} \]
401 What is the fifteenth term of the sequence 5, −10, 20, −40, 80, . . .?
   1 −163,840
   2 −81,920
   3 81,920
   4 327,680

402 What is the fifteenth term of the geometric sequence −5, 10, −25, . . .?
   1 −128 5
   2 128 10
   3 −16384 5
   4 16384 10

403 An arithmetic sequence has a first term of 10 and a sixth term of 40. What is the 20th term of this sequence?
   1 105
   2 110
   3 124
   4 130

404 Find the first four terms of the recursive sequence defined below.
   \[ a_1 = -3 \]
   \[ a_n = a_{n-1} - n \]

405 Find the third term in the recursive sequence \[ a_{k+1} = 2a_k - 1 \], where \( a_1 = 3 \).

406 Use the recursive sequence defined below to express the next three terms as fractions reduced to lowest terms.
   \[ a_1 = 2 \]
   \[ a_n = 3(a_{n-1})^{-2} \]

407 What is the fourth term of the sequence defined by \[ a_1 = 3xy^5 \]
   \[ a_n = \left(\frac{2x}{y}\right)a_{n-1} \]
   1 \(12x^3y^3\)
   2 \(24x^2y^4\)
   3 \(24x^4y^2\)
   4 \(48x^5y\)

408 The first four terms of the sequence defined by \[ a_1 = \frac{1}{2} \] and \( a_{n+1} = 1 - a_n \) are
   1 \(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}\)
   2 \(\frac{1}{2}, 1, 1, \frac{1}{2}, 2\)
   3 \(\frac{1}{2}, 1 \frac{1}{2}, 4, \frac{1}{8}, 16\)
   4 \(\frac{1}{2}, 1 \frac{1}{2}, 2 \frac{1}{2}, 3 \frac{1}{2}\)

409 What is the third term of the recursive sequence defined below?
   \[ a_1 = -6 \]
   \[ a_n = \frac{1}{2}a_{n-1} - n \]
   1 \(-\frac{11}{2}\)
   2 \(-\frac{5}{2}\)
   3 \(-\frac{1}{2}\)
   4 \(-4\)

410 The value of the expression \(2 \sum_{n=0}^{2} (n^2 + 2^n)\) is
   1 12
   2 22
   3 24
   4 26
411 Evaluate: \(10 + \sum_{n=1}^{5} (n^3 - 1)\)

412 The value of the expression \(\sum_{r=3}^{5} (-r^2 + r)\) is

1. \(-38\)
2. \(-12\)
3. \(26\)
4. \(62\)

413 Evaluate: \(\sum_{n=1}^{3} (-n^4 - n)\)

414 The expression \(4 + \sum_{k=2}^{5} 3(k-x)\) is equal to

1. \(58 - 4x\)
2. \(46 - 4x\)
3. \(58 - 12x\)
4. \(46 - 12x\)

415 Which expression is equivalent to \(\sum_{n=1}^{4} (a-n)^2\)?

1. \(2a^2 + 17\)
2. \(4a^2 + 30\)
3. \(2a^2 - 10a + 17\)
4. \(4a^2 - 20a + 30\)

416 What is the value of \(\sum_{x=0}^{2} (3-2a)^x\)?

1. \(4a^2 - 2a + 12\)
2. \(4a^2 - 2a + 13\)
3. \(4a^2 - 14a + 12\)
4. \(4a^2 - 14a + 13\)

417 Simplify: \(\sum_{a=1}^{4} (x - a^2)\).

418 What is the value of \(\sum_{n=1}^{3} \cos \frac{n \pi}{2}\)?

1. \(-1\)
2. \(1\)
3. \(0\)
4. \(\frac{1}{2}\)

419 Mrs. Hill asked her students to express the sum \(1 + 3 + 5 + 7 + 9 + \ldots + 39\) using sigma notation. Four different student answers were given. Which student answer is correct?

1. \(\sum_{k=1}^{20} (2k - 1)\)
2. \(\sum_{k=1}^{40} (k - 1)\)
3. \(\sum_{k=1}^{37} (k + 2)\)
4. \(\sum_{k=1}^{39} (2k - 1)\)

420 Express the sum \(7 + 14 + 21 + 28 + \ldots + 105\) using sigma notation.

421 Which summation represents \(5 + 7 + 9 + 11 + \ldots + 43\)?

1. \(\sum_{n=5}^{43} n\)
2. \(\sum_{n=1}^{20} (2n + 3)\)
3. \(\sum_{n=4}^{24} (2n - 3)\)
4. \(\sum_{n=3}^{23} (3n - 4)\)
422 A jogger ran \( \frac{1}{3} \) mile on day 1, and \( \frac{2}{3} \) mile on day 2, and \( 1 \frac{1}{3} \) miles on day 3, and \( 2 \frac{2}{3} \) miles on day 4, and this pattern continued for 3 more days. Which expression represents the total distance the jogger ran?

1 \( \sum_{d=1}^{7} \left(\frac{1}{3}\right)^{d-1} \)
2 \( \sum_{d=1}^{7} \frac{1}{3} (2)^d \)
3 \( \sum_{d=1}^{7} 2 \left(\frac{1}{3}\right)^{d-1} \)
4 \( \sum_{d=1}^{7} 2 \left(\frac{1}{3}\right)^d \)

423 Which expression is equivalent to the sum of the sequence 6,12,20,30?

1 \( \sum_{n=4}^{7} 2^n - 10 \)
2 \( \sum_{n=3}^{6} \frac{2n^2}{3} \)
3 \( \sum_{n=2}^{5} 5n - 4 \)
4 \( \sum_{n=2}^{5} n^2 + n \)

425 What is the sum of the first 19 terms of the sequence 3,10,17,24,31,…?

1 1188
2 1197
3 1254
4 1292

426 Determine the sum of the first twenty terms of the sequence whose first five terms are 5, 14, 23, 32, 41.

427 The sum of the first eight terms of the series \( 3 - 12 + 48 - 192 + \ldots \) is

1 -13,107
2 -21,845
3 -39,321
4 -65,535

TRIGONOMETRY

A2.A.55: TRIGONOMETRIC RATIOS

428 In the diagram below of right triangle \( KTW \), \( KW = 6 \), \( KT = 5 \), and \( m \angle KTW = 90 \).

What is the measure of \( \angle K \), to the nearest minute?

1 33°33′
2 33°34′
3 33°55′
4 33°56′
429 Which ratio represents \( \csc A \) in the diagram below?

\[
\begin{array}{cccc}
1 & \frac{25}{24} \\
2 & \frac{25}{7} \\
3 & \frac{24}{7} \\
4 & \frac{7}{24}
\end{array}
\]

430 In the diagram below of right triangle \( JTM \), \( JT = 12 \), \( JM = 6 \), and \( m \angle JMT = 90 \).

What is the value of \( \cot J \)?

\[
\begin{array}{cccc}
1 & \frac{\sqrt{3}}{3} \\
2 & 2 \\
3 & \sqrt{3} \\
4 & \frac{2\sqrt{3}}{3}
\end{array}
\]

431 In the diagram below, the length of which line segment is equal to the exact value of \( \sin \theta \)?

\[
\begin{array}{cccc}
1 & \overline{TO} \\
2 & \overline{TS} \\
3 & \overline{OR} \\
4 & \overline{OS}
\end{array}
\]

432 In the right triangle shown below, what is the measure of angle \( S \), to the nearest minute?

\[
\begin{array}{cccc}
1 & 28^\circ 1' \\
2 & 28^\circ 4' \\
3 & 61^\circ 56' \\
4 & 61^\circ 93'
\end{array}
\]

433 By law, a wheelchair service ramp may be inclined no more than 4.76\(^\circ\). If the base of a ramp begins 15 feet from the base of a public building, which equation could be used to determine the maximum height, \( h \), of the ramp where it reaches the building’s entrance?

\[
\begin{array}{cccc}
1 & \sin 4.76^\circ = \frac{h}{15} \\
2 & \sin 4.76^\circ = \frac{15}{h} \\
3 & \tan 4.76^\circ = \frac{h}{15} \\
4 & \tan 4.76^\circ = \frac{15}{h}
\end{array}
\]
A2.M.1-2: RADIAN MEASURE

434 What is the radian measure of the smaller angle formed by the hands of a clock at 7 o’clock?
1 \( \frac{\pi}{2} \)
2 \( \frac{2\pi}{3} \)
3 \( \frac{5\pi}{6} \)
4 \( \frac{7\pi}{6} \)

435 The terminal side of an angle measuring \( \frac{4\pi}{5} \) radians lies in Quadrant
1 I
2 II
3 III
4 IV

436 Find, to the nearest minute, the angle whose measure is 3.45 radians.

437 What is the number of degrees in an angle whose radian measure is \( \frac{11\pi}{12} \) ?
1 150
2 165
3 330
4 518

438 What is the radian measure of an angle whose measure is \(-420^\circ\) ?
1 \( \frac{7\pi}{3} \)
2 \( \frac{7\pi}{6} \)
3 \( \frac{7\pi}{6} \)
4 \( \frac{7\pi}{3} \)

439 Find, to the nearest tenth of a degree, the angle whose measure is 2.5 radians.

440 What is the number of degrees in an angle whose measure is 2 radians?
1 \( \frac{360}{\pi} \)
2 \( \frac{\pi}{360} \)
3 360
4 90

441 Find, to the nearest tenth, the radian measure of 216°.

442 Convert 3 radians to degrees and express the answer to the nearest minute.

443 What is the number of degrees in an angle whose radian measure is \( \frac{8\pi}{5} \) ?
1 576
2 288
3 225
4 113

444 Approximately how many degrees does five radians equal?
1 286
2 900
3 \( \frac{\pi}{36} \)
4 \( 5\pi \)

445 Convert 2.5 radians to degrees, and express the answer to the nearest minute.

446 Determine, to the nearest minute, the degree measure of an angle of \( \frac{5}{11} \pi \) radians.

447 Determine, to the nearest minute, the number of degrees in an angle whose measure is 2.5 radians.

448 Express \(-130^\circ\) in radian measure, to the nearest hundredth.
A2.A.60: UNIT CIRCLE, FINDING THE TERMINAL SIDE OF AN ANGLE

449 On the unit circle shown in the diagram below, sketch an angle, in standard position, whose degree measure is 240 and find the exact value of \( \sin 240° \).

450 In which graph is \( \theta \) coterminal with an angle of \(-70°\)?
451 If $m\angle \theta = -50$, which diagram represents $\theta$ drawn in standard position?

1

2

3

4

452 Which angle does not terminate in Quadrant IV when drawn on a unit circle in standard position?

1 $-300^\circ$
2 $-50^\circ$
3 $280^\circ$
4 $1030^\circ$

453 An angle, $P$, drawn in standard position, terminates in Quadrant II if

1 $\cos P < 0$ and $\csc P > 0$
2 $\sin P > 0$ and $\cos P < 0$
3 $\csc P > 0$ and $\cot P < 0$
4 $\tan P < 0$ and $\sec P > 0$

454 If $\sin \theta < 0$ and $\cot \theta > 0$, in which quadrant does the terminal side of angle $\theta$ lie?

1 I
2 II
3 III
4 IV

A2.A.56, 62, 66: DETERMINING TRIGONOMETRIC FUNCTIONS

455 In the interval $0^\circ \leq x < 360^\circ$, $\tan x$ is undefined when $x$ equals

1 $0^\circ$ and $90^\circ$
2 $90^\circ$ and $180^\circ$
3 $180^\circ$ and $270^\circ$
4 $90^\circ$ and $270^\circ$

456 Express the product of $\cos 30^\circ$ and $\sin 45^\circ$ in simplest radical form.

457 If $\theta$ is an angle in standard position and its terminal side passes through the point $(-3,2)$, find the exact value of $\csc \theta$.

458 Angle $\theta$ is in standard position and $(-4,0)$ is a point on the terminal side of $\theta$. What is the value of $\sec \theta$?

1 $-4$
2 $-1$
3 $0$
4 undefined
459 Circle $O$ has a radius of 2 units. An angle with a measure of $\frac{\pi}{6}$ radians is in standard position. If the terminal side of the angle intersects the circle at point $B$, what are the coordinates of $B$?

1. $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
2. $\left(\sqrt{3}, 1\right)$
3. $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
4. $\left(1, \sqrt{3}\right)$

460 If the terminal side of angle $\theta$ passes through point $(-3, -4)$, what is the value of $\sec \theta$?

1. $\frac{5}{3}$
2. $-\frac{5}{3}$
3. $\frac{5}{4}$
4. $-\frac{5}{4}$

461 The value of $\tan 126^\circ43'$ to the nearest ten-thousandth is

1. $-1.3407$
2. $-1.3408$
3. $-1.3548$
4. $-1.3549$

462 Which expression, when rounded to three decimal places, is equal to $-1.155$?

1. $\sec \left(\frac{5\pi}{6}\right)$
2. $\tan(49^\circ20')$
3. $\sin\left(-\frac{3\pi}{5}\right)$
4. $\csc(-118^\circ)$

463 The value of $\csc 138^\circ23'$ rounded to four decimal places is

1. $-1.3376$
2. $-1.3408$
3. $1.5012$
4. $1.5057$

A2.A.64: USING INVERSE TRIGONOMETRIC FUNCTIONS

464 What is the principal value of $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$?

1. $-30^\circ$
2. $60^\circ$
3. $150^\circ$
4. $240^\circ$

465 In the diagram below of a unit circle, the ordered pair $\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$ represents the point where the terminal side of $\theta$ intersects the unit circle.

What is $m\angle \theta$?

1. $45$
2. $135$
3. $225$
4. $240$
466 If \( \sin^{-1}\left(\frac{5}{8}\right) = A \), then

1. \( \sin A = \frac{5}{8} \)
2. \( \sin A = \frac{8}{5} \)
3. \( \cos A = \frac{5}{8} \)
4. \( \cos A = \frac{8}{5} \)

467 If \( \tan\left(\text{Arc cos} \frac{\sqrt{3}}{k}\right) = \frac{\sqrt{3}}{3} \), then \( k \) is

1. 1
2. 2
3. \( \sqrt{2} \)
4. \( 3\sqrt{2} \)

468 If \( \sin A = -\frac{7}{25} \) and \( \angle A \) terminates in Quadrant IV,

\( \tan A \) equals

1. \( -\frac{7}{25} \)
2. \( -\frac{7}{24} \)
3. \( -\frac{24}{7} \)
4. \( \frac{24}{25} \)

469 What is the value of \( \tan\left(\text{Arc cos} \frac{15}{17}\right) \)?

1. \( \frac{8}{15} \)
2. \( \frac{8}{17} \)
3. \( \frac{15}{8} \)
4. \( \frac{17}{8} \)

A2.A.57: REFERENCE ANGLES

470 Expressed as a function of a positive acute angle, \( \cos(-305^\circ) \) is equal to

1. \( -\cos 55^\circ \)
2. \( \cos 55^\circ \)
3. \( -\sin 55^\circ \)
4. \( \sin 55^\circ \)

471 Expressed as a function of a positive acute angle, \( \sin 230^\circ \) is equal to

1. \( -\sin 40^\circ \)
2. \( -\sin 50^\circ \)
3. \( \sin 40^\circ \)
4. \( \sin 50^\circ \)

A2.A.61: ARC LENGTH

472 A circle has a radius of 4 inches. In inches, what is the length of the arc intercepted by a central angle of 2 radians?

1. \( 2\pi \)
2. \( 2 \)
3. \( 8\pi \)
4. \( 8 \)

473 A circle is drawn to represent a pizza with a 12 inch diameter. The circle is cut into eight congruent pieces. What is the length of the outer edge of any one piece of this circle?

1. \( \frac{3\pi}{4} \)
2. \( \pi \)
3. \( \frac{3\pi}{2} \)
4. \( 3\pi \)
474 Circle $O$ shown below has a radius of 12 centimeters. To the nearest tenth of a centimeter, determine the length of the arc, $x$, subtended by an angle of $83^\circ 50'$.

![Diagram of circle with arc](image)

475 A wheel has a radius of 18 inches. Which distance, to the nearest inch, does the wheel travel when it rotates through an angle of $\frac{2\pi}{5}$ radians?

1 45
2 23
3 13
4 11

476 In a circle, an arc length of 6.6 is intercepted by a central angle of $\frac{2}{3}$ radians. Determine the length of the radius.

477 In a circle with a diameter of 24 cm, a central angle of $\frac{4\pi}{3}$ radians intercepts an arc. The length of the arc, in centimeters, is

1 8\pi
2 9\pi
3 16\pi
4 32\pi

478 If $\angle A$ is acute and $\tan A = \frac{2}{3}$, then

1 $\cot A = \frac{2}{3}$
2 $\cot A = \frac{1}{3}$
3 $\cot(90^\circ - A) = \frac{2}{3}$
4 $\cot(90^\circ - A) = \frac{1}{3}$

479 The expression $\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta}$ is equivalent to

1 $\cos^2 \theta$
2 $\sin^2 \theta$
3 $\sec^2 \theta$
4 $\csc^2 \theta$

480 Express $\cos \theta (\sec \theta - \cos \theta)$, in terms of $\sin \theta$.

481 If $\sec(a + 15)^\circ = \csc(2a)^\circ$, find the smallest positive value of $a$, in degrees.

482 Express $\cot x \sin x \sec x$ as a single trigonometric function, in simplest form, for all values of $x$ for which it is defined.

483 The expression $\frac{\cot x}{\csc x}$ is equivalent to

1 $\sin x$
2 $\cos x$
3 $\tan x$
4 $\sec x$

484 Which trigonometric expression does not simplify to 1?

1 $\sin^2 x (1 + \cot^2 x)$
2 $\sec^2 x (1 - \sin^2 x)$
3 $\cos^2 x (\tan^2 x - 1)$
4 $\cot^2 x (\sec^2 x - 1)$
485 Show that \( \frac{\sec^2 x - 1}{\sec^2 x} \) is equivalent to \( \sin^2 x \).

486 If angles \( A \) and \( B \) are complementary, then sec \( B \) equals
1. \( \csc(90^\circ - B) \)
2. \( \csc(B - 90^\circ) \)
3. \( \cos(B - 90^\circ) \)
4. \( \cos(90^\circ - B) \)

487 Express the exact value of \( \csc 60^\circ \), with a rational denominator.

488 The exact value of \( \csc 120^\circ \) is
1. \( \frac{2\sqrt{3}}{3} \)
2. \( 2 \)
3. \( \frac{2\sqrt{3}}{3} \)
4. \( -2 \)

489 Which expression always equals 1?
1. \( \cos^2 x - \sin^2 x \)
2. \( \cos^2 x + \sin^2 x \)
3. \( \cos x - \sin x \)
4. \( \cos x + \sin x \)

490 Starting with \( \sin^2 A + \cos^2 A = 1 \), derive the formula \( \tan^2 A + 1 = \sec^2 A \).

491 Show that \( \sec \theta \sin \theta \cot \theta = 1 \) is an identity.

492 Prove that the equation shown below is an identity for all values for which the functions are defined: \( \csc \theta \cdot \sin^2 \theta \cdot \cot \theta = \cos \theta \)

493 The expression \( \cos 4x \cos 3x + \sin 4x \sin 3x \) is equivalent to
1. \( \sin x \)
2. \( \sin 7x \)
3. \( \cos x \)
4. \( \cos 7x \)

494 If \( \tan A = \frac{2}{3} \) and \( \sin B = \frac{5}{\sqrt{41}} \) and angles \( A \) and \( B \) are in Quadrant I, find the value of \( \tan(A + B) \).

495 Express as a single fraction the exact value of \( \sin 75^\circ \).

496 Given angle \( A \) in Quadrant I with \( \sin A = \frac{12}{13} \) and angle \( B \) in Quadrant II with \( \cos B = \frac{3}{5} \), what is the value of \( \cos(A - B) \)?
1. \( \frac{33}{65} \)
2. \( \frac{33}{65} \)
3. \( \frac{63}{65} \)
4. \( \frac{63}{65} \)

497 The value of \( \sin(180 + x) \) is equivalent to
1. \( -\sin x \)
2. \( -\sin(90 - x) \)
3. \( \sin x \)
4. \( \sin(90 - x) \)

498 The expression \( \sin(\theta + 90)^\circ \) is equivalent to
1. \( -\sin \theta \)
2. \( -\cos \theta \)
3. \( \sin \theta \)
4. \( \cos \theta \)
499 If \( \sin x = \sin y = a \) and \( \cos x = \cos y = b \), then \( \cos(x - y) \) is
1. \( b^2 - a^2 \)
2. \( b^2 + a^2 \)
3. \( 2b - 2a \)
4. \( 2b + 2a \)

A2.A.77: DOUBLE AND HALF ANGLE IDENTITIES

500 The expression \( \cos^2 \theta - \cos 2 \theta \) is equivalent to
1. \( \sin^2 \theta \)
2. \( -\sin^2 \theta \)
3. \( \cos^2 \theta + 1 \)
4. \( -\cos^2 \theta - 1 \)

501 If \( \sin A = \frac{2}{3} \) where \( 0^\circ < A < 90^\circ \), what is the value of \( \sin 2A \)?
1. \( \frac{2\sqrt{5}}{3} \)
2. \( \frac{2\sqrt{5}}{9} \)
3. \( \frac{4\sqrt{5}}{9} \)
4. \( -\frac{4\sqrt{5}}{9} \)

502 What is a positive value of \( \tan \frac{1}{2} x \), when \( \sin x = 0.8 \)?
1. 0.5
2. 0.4
3. 0.33
4. 0.25

503 If \( \sin A = \frac{1}{3} \), what is the value of \( \cos 2A \)?
1. \( \frac{2}{3} \)
2. \( \frac{2}{5} \)
3. \( \frac{7}{9} \)
4. \( \frac{7}{9} \)

504 If \( \sin A = \frac{3}{8} \), what is the value of \( \cos 2A \)?
1. \( \frac{9}{64} \)
2. \( \frac{1}{4} \)
3. \( \frac{23}{32} \)
4. \( \frac{55}{64} \)

505 The expression \( \frac{1 + \cos 2A}{\sin 2A} \) is equivalent to
1. \( \cot A \)
2. \( \tan A \)
3. \( \sec A \)
4. \( 1 + \cot 2A \)

506 If \( \cos \theta = \frac{3}{4} \), then what is \( \cos 2\theta \)?
1. \( \frac{1}{8} \)
2. \( \frac{9}{16} \)
3. \( \frac{1}{8} \)
4. \( \frac{3}{2} \)
A2.A.68: TRIGONOMETRIC EQUATIONS

507 What are the values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$ that satisfy the equation $\tan \theta - \sqrt{3} = 0$?
1. $60^\circ, 240^\circ$
2. $72^\circ, 252^\circ$
3. $72^\circ, 108^\circ, 252^\circ, 288^\circ$
4. $60^\circ, 120^\circ, 240^\circ, 300^\circ$

508 Find all values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$ that satisfy the equation $\sin 2\theta = \sin \theta$.

509 Solve the equation $2\tan C - 3 = 3\tan C - 4$ algebraically for all values of $C$ in the interval $0^\circ \leq C < 360^\circ$.

510 What is the solution set for $2\cos \theta - 1 = 0$ in the interval $0^\circ \leq \theta < 360^\circ$?
1. $\{30^\circ, 150^\circ\}$
2. $\{60^\circ, 120^\circ\}$
3. $\{30^\circ, 330^\circ\}$
4. $\{60^\circ, 300^\circ\}$

511 What is the solution set of the equation $-\sqrt{2} \sec x = 2$ when $0^\circ \leq x < 360^\circ$?
1. $\{45^\circ, 135^\circ, 225^\circ, 315^\circ\}$
2. $\{45^\circ, 315^\circ\}$
3. $\{135^\circ, 225^\circ\}$
4. $\{225^\circ, 315^\circ\}$

512 Find, algebraically, the measure of the obtuse angle, to the nearest degree, that satisfies the equation $5 \csc \theta = 8$.

513 Solve algebraically for all exact values of $x$ in the interval $0 \leq x < 2\pi$: $2\sin^2 x + 5 \sin x = 3$

514 Solve $\sec x - \sqrt{2} = 0$ algebraically for all values of $x$ in $0^\circ \leq x < 360^\circ$.

515 In the interval $0^\circ \leq \theta < 360^\circ$, solve the equation $5\cos \theta = 2\sec \theta - 3$ algebraically for all values of $\theta$, to the nearest tenth of a degree.

516 Which values of $x$ in the interval $0^\circ \leq x < 360^\circ$ satisfy the equation $2\sin^2 x + \sin x - 1 = 0$?
1. $\{30^\circ, 270^\circ\}$
2. $\{30^\circ, 150^\circ, 270^\circ\}$
3. $\{90^\circ, 210^\circ, 330^\circ\}$
4. $\{90^\circ, 210^\circ, 270^\circ, 330^\circ\}$

517 Solve the equation $\cos 2x = \cos x$ algebraically for all values of $x$ in the interval $0^\circ \leq x < 360^\circ$.

A2.A.69: PROPERTIES OF TRIGONOMETRIC FUNCTIONS

518 What is the period of the function $y = \frac{1}{2} \sin \left(\frac{x}{3} - \pi\right)$?
1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{2}{3} \pi$
4. $6\pi$

519 What is the period of the function $f(\theta) = -2\cos 3\theta$?
1. $\pi$
2. $\frac{2\pi}{3}$
3. $\frac{3\pi}{2}$
4. $2\pi$

520 Which equation represents a graph that has a period of $4\pi$?
1. $y = 3\sin \frac{1}{2} x$
2. $y = 3\sin 2x$
3. $y = 3\sin \frac{1}{4} x$
4. $y = 3\sin 4x$
521 What is the period of the graph \( y = \frac{1}{2} \sin 6x \)?

1. \( \frac{\pi}{6} \)
2. \( \frac{\pi}{3} \)
3. \( \frac{\pi}{2} \)
4. \( 6\pi \)

522 How many full cycles of the function \( y = 3 \sin 2x \) appear in \( \pi \) radians?

1. 1
2. 2
3. 3
4. 4

523 What is the period of the graph of the equation \( y = \frac{1}{3} \sin 2x \)?

1. \( \frac{1}{3} \)
2. \( 2 \)
3. \( \pi \)
4. \( 6\pi \)

524 What are the amplitude and the period of the graph represented by the equation \( y = -3 \cos \frac{\theta}{3} \)?

1. amplitude: \(-3\); period: \( \frac{\pi}{3} \)
2. amplitude: \(-3\); period: \( 6\pi \)
3. amplitude: \(3\); period: \( \frac{\pi}{3} \)
4. amplitude: \(3\); period: \( 6\pi \)

525 Which equation is graphed in the diagram below?

1. \( y = 3 \cos \left( \frac{\pi}{30} x \right) + 8 \)
2. \( y = 3 \cos \left( \frac{\pi}{15} x \right) + 5 \)
3. \( y = -3 \cos \left( \frac{\pi}{30} x \right) + 8 \)
4. \( y = -3 \cos \left( \frac{\pi}{15} x \right) + 5 \)

526 Write an equation for the graph of the trigonometric function shown below.
527 Which equation is represented by the graph below?

1. \( y = 2 \cos 3x \)
2. \( y = 2 \sin 3x \)
3. \( y = 2 \cos \frac{2\pi}{3} x \)
4. \( y = 2 \sin \frac{2\pi}{3} x \)

528 Which equation represents the graph below?

1. \( y = -2 \sin 2x \)
2. \( y = -2 \sin \frac{1}{2} x \)
3. \( y = -2 \cos 2x \)
4. \( y = -2 \cos \frac{1}{2} x \)

529 The periodic graph below can be represented by the trigonometric equation \( y = a \cos bx + c \) where \( a, b, \) and \( c \) are real numbers.

State the values of \( a, b, \) and \( c, \) and write an equation for the graph.
A2.A.65, 70-71: GRAPHING TRIGONOMETRIC FUNCTIONS

530 Which graph represents the equation \( y = \cos^{-1}x \)?

- 1
- 2
- 3
- 4

531 Which graph shows \( y = \cos^{-1}x \)?

- 1
- 2
- 3
- 4
532 Which graph represents one complete cycle of the equation $y = \sin 3\pi x$?

533 Which equation is represented by the graph below?

534 Which equation is sketched in the diagram below?
535 Which is a graph of \( y = \cot x \)?

![Graphs of \( y = \cot x \)]

1

2

3

4

A2.A.63: DOMAIN AND RANGE

536 The function \( f(x) = \tan x \) is defined in such a way that \( f^{-1}(x) \) is a function. What can be the domain of \( f(x) \)?

1 \( \{x | 0 \leq x \leq \pi \} \)

2 \( \{x | 0 \leq x \leq 2\pi \} \)

3 \( \left\{ x \mid -\frac{\pi}{2} < x < \frac{\pi}{2} \right\} \)

4 \( \left\{ x \mid -\frac{\pi}{2} < x < \frac{3\pi}{2} \right\} \)

537 In which interval of \( f(x) = \cos(x) \) is the inverse also a function?

1 \( -\frac{\pi}{2} < x < \frac{\pi}{2} \)

2 \( -\frac{\pi}{2} \leq x \leq \frac{\pi}{2} \)

3 \( 0 \leq x \leq \pi \)

4 \( \frac{\pi}{2} \leq x \leq \frac{3\pi}{2} \)

538 Which statement regarding the inverse function is true?

1 A domain of \( y = \sin^{-1}x \) is \([0, 2\pi]\).

2 The range of \( y = \sin^{-1}x \) is \([-1, 1]\).

3 A domain of \( y = \cos^{-1}x \) is \((-\infty, \infty)\).

4 The range of \( y = \cos^{-1}x \) is \([0, \pi]\).

539 When the inverse of \( \tan \theta \) is sketched, its domain is

1 \( -1 \leq \theta \leq 1 \)

2 \( -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2} \)

3 \( 0 \leq \theta \leq \pi \)

4 \( -\infty < \theta < \infty \)

A2.A.74: USING TRIGONOMETRY TO FIND AREA

540 In \( \triangle ABC \), \( m\angle A = 120 \), \( b = 10 \), and \( c = 18 \). What is the area of \( \triangle ABC \) to the nearest square inch?

1 52

2 78

3 90

4 156

541 Two sides of a parallelogram are 24 feet and 30 feet. The measure of the angle between these sides is 57°. Find the area of the parallelogram, to the nearest square foot.

542 The sides of a parallelogram measure 10 cm and 18 cm. One angle of the parallelogram measures 46 degrees. What is the area of the parallelogram, to the nearest square centimeter?

1 65

2 125

3 129

4 162
543 In parallelogram $BFLO$, $OL = 3.8$, $LF = 7.4$, and $m \angle O = 126^\circ$. If diagonal $BL$ is drawn, what is the area of $\triangle BLF$?
1  11.4  
2  14.1  
3  22.7  
4  28.1  

544 The two sides and included angle of a parallelogram are 18, 22, and $60^\circ$. Find its exact area in simplest form.

545 The area of triangle $ABC$ is 42. If $AB = 8$ and $m \angle B = 61$, the length of $BC$ is approximately
1  5.1  
2  9.2  
3  12.0  
4  21.7  

546 A ranch in the Australian Outback is shaped like triangle $ACE$, with $m \angle A = 42$, $m \angle E = 103$, and $AC = 15$ miles. Find the area of the ranch, to the nearest square mile.

547 Find, to the nearest tenth of a square foot, the area of a rhombus that has a side of 6 feet and an angle of $50^\circ$.  

548 Two sides of a triangular-shaped sandbox measure 22 feet and 13 feet. If the angle between these two sides measures $55^\circ$, what is the area of the sandbox, to the nearest square foot?
1  82  
2  117  
3  143  
4  234  

549 The area of a parallelogram is 594, and the lengths of its sides are 32 and 46. Determine, to the nearest tenth of a degree, the measure of the acute angle of the parallelogram.

550 What is the area of a parallelogram that has sides measuring 8 cm and 12 cm and includes an angle of $120^\circ$?
1  $24\sqrt{3}$  
2  $48\sqrt{3}$  
3  $83\sqrt{3}$  
4  $96\sqrt{3}$  

551 Determine the area, to the nearest integer, of $\triangle SRO$ shown below.

552 In $\triangle ABC$, $m \angle A = 32$, $a = 12$, and $b = 10$. Find the measures of the missing angles and side of $\triangle ABC$. Round each measure to the nearest tenth.

553 The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of $65$ degrees with the ground. From a point on the ground 100 feet from the end of the guy wire, the angle of elevation to the top of the tower is $32$ degrees. Find the height of the tower, to the nearest foot.
554 As shown in the diagram below, fire-tracking station $A$ is 100 miles due west of fire-tracking station $B$. A forest fire is spotted at $F$, on a bearing $47^\circ$ northeast of station $A$ and $15^\circ$ northeast of station $B$. Determine, to the nearest tenth of a mile, the distance the fire is from both station $A$ and station $B$. [N represents due north.]

![Diagram showing fire-tracking stations and fire location](image)

555 In $\triangle PQR$, $p$ equals

1. $\frac{r \sin P}{\sin Q}$
2. $\frac{r \sin P}{\sin R}$
3. $\frac{r \sin R}{\sin P}$
4. $\frac{q \sin R}{\sin Q}$

556 Given: $DC = 10$, $AG = 15$, $BE = 6$, $FE = 10$, $m\angle ABG = 40$, $m\angle GBD = 90$, $m\angle C < 90$, $BE \cong ED$, and $GF \cong FB$

![Diagram showing additional points and distances](image)

Find $m\angle A$ to the nearest tenth. Find $BC$ to the nearest tenth.  

A2.A.75: LAW OF SINES-THE AMBIGUOUS CASE

557 In $\triangle ABC$, $m\angle A = 74$, $a = 59.2$, and $c = 60.3$. What are the two possible values for $m\angle C$, to the nearest tenth?

1. 73.7 and 106.3
2. 73.7 and 163.7
3. 78.3 and 101.7
4. 78.3 and 168.3

558 How many distinct triangles can be formed if $m\angle A = 35$, $a = 10$, and $b = 13$?

1. 1
2. 2
3. 3
4. 0

559 Given $\triangle ABC$ with $a = 9$, $b = 10$, and $m\angle B = 70$, what type of triangle can be drawn?

1. an acute triangle, only
2. an obtuse triangle, only
3. both an acute triangle and an obtuse triangle
4. neither an acute triangle nor an obtuse triangle
560 In \( \triangle MNP \), \( m = 6 \) and \( n = 10 \). Two distinct triangles can be constructed if the measure of angle \( M \) is
1. 35
2. 40
3. 45
4. 50

561 In \( \triangle KLM \), \( KL = 20 \), \( LM = 13 \), and \( \angle K = 40 \). The measure of \( \angle M \) is
1. must be between 0° and 90°
2. must equal 90°
3. must be between 90° and 180°
4. is ambiguous

562 In \( \triangle DEF \), \( d = 5 \), \( e = 8 \), and \( \angle D = 32 \). How many distinct triangles can be drawn given these measurements?
1. 1
2. 2
3. 3
4. 0

563 How many distinct triangles can be constructed if \( \angle A = 30 \), side \( a = \sqrt{34} \), and side \( b = 12 \)?
1. one acute triangle
2. one obtuse triangle
3. two triangles
4. none

564 In triangle \( ABC \), determine the number of distinct triangles that can be formed if \( \angle A = 85 \), side \( a = 8 \), and side \( c = 2 \). Justify your answer.

A2.A.73: LAW OF COSINES

565 In a triangle, two sides that measure 6 cm and 10 cm form an angle that measures 80°. Find, to the nearest degree, the measure of the smallest angle in the triangle.

566 In \( \triangle ABC \), \( a = 3 \), \( b = 5 \), and \( c = 7 \). What is \( \angle C \)?
1. 22
2. 38
3. 60
4. 120

567 In \( \triangle ABC \), \( a = 15 \), \( b = 14 \), and \( c = 13 \), as shown in the diagram below. What is the \( \angle C \), to the nearest degree?

568 Two sides of a parallelogram measure 27 cm and 32 cm. The included angle measures 48°. Find the length of the longer diagonal of the parallelogram, to the nearest centimeter.

569 In \( \triangle FGH \), \( f = 6 \), \( g = 9 \), and \( \angle H = 57 \). Which statement can be used to determine the numerical value of \( h \)?
1. \( h^2 = 6^2 + 9^2 - 2(9)(h) \cos 57° \)
2. \( h^2 = 6^2 + 9^2 - 2(6)(9) \cos 57° \)
3. \( 6^2 = 9^2 + h^2 - 2(9)(h) \cos 57° \)
4. \( 9^2 = 6^2 + h^2 - 2(6)(h) \cos 57° \)

570 Find the measure of the smallest angle, to the nearest degree, of a triangle whose sides measure 28, 47, and 34.

571 In a triangle, two sides that measure 8 centimeters and 11 centimeters form an angle that measures 82°. To the nearest tenth of a degree, determine the measure of the smallest angle in the triangle.
572 Two forces of 25 newtons and 85 newtons acting on a body form an angle of 55°. Find the magnitude of the resultant force, to the nearest hundredth of a newton. Find the measure, to the nearest degree, of the angle formed between the resultant and the larger force.

573 The measures of the angles between the resultant and two applied forces are 60° and 45°, and the magnitude of the resultant is 27 pounds. Find, to the nearest pound, the magnitude of each applied force.

574 Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound. Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

CONICS
A2.A.47-49: EQUATIONS OF CIRCLES

575 The equation \( x^2 + y^2 - 2x + 6y + 3 = 0 \) is equivalent to

1. \( (x - 1)^2 + (y + 3)^2 = -3 \)
2. \( (x - 1)^2 + (y + 3)^2 = 7 \)
3. \( (x + 1)^2 + (y + 3)^2 = 7 \)
4. \( (x + 1)^2 + (y + 3)^2 = 10 \)

576 What are the coordinates of the center of a circle whose equation is \( x^2 + y^2 - 16x + 6y + 53 = 0 \)?

1. \((-8,-3)\)
2. \((-8,3)\)
3. \((8,-3)\)
4. \((8,3)\)

577 What is the equation of the circle passing through the point \((6,5)\) and centered at \((3,-4)\)?

1. \( (x - 6)^2 + (y - 5)^2 = 82 \)
2. \( (x - 6)^2 + (y - 5)^2 = 90 \)
3. \( (x - 3)^2 + (y + 4)^2 = 82 \)
4. \( (x - 3)^2 + (y + 4)^2 = 90 \)

578 Which equation represents a circle with its center at \((2,-3)\) and that passes through the point \((6,2)\)?

1. \( (x - 2)^2 + (y + 3)^2 = \sqrt{41} \)
2. \( (x + 2)^2 + (y - 3)^2 = \sqrt{41} \)
3. \( (x - 2)^2 + (y + 3)^2 = 41 \)
4. \( (x + 2)^2 + (y - 3)^2 = 41 \)

579 What is the equation of a circle with its center at \((0,-2)\) and passing through the point \((3,-5)\)?

1. \( x^2 + (y + 2)^2 = 9 \)
2. \( (x + 2)^2 + y^2 = 9 \)
3. \( x^2 + (y + 2)^2 = 18 \)
4. \( (x + 2)^2 + y^2 = 18 \)

580 Write an equation of the circle shown in the graph below.
581 A circle shown in the diagram below has a center of \((-5,3)\) and passes through point \((-1,7)\).

Write an equation that represents the circle.

582 Which equation represents the circle shown in the graph below that passes through the point \((0,-1)\)?

1. \((x-3)^2 + (y+4)^2 = 16\)
2. \((x-3)^2 + (y+4)^2 = 18\)
3. \((x+3)^2 + (y-4)^2 = 16\)
4. \((x+3)^2 + (y-4)^2 = 18\)

583 Write an equation of the circle shown in the diagram below.

584 Which equation is represented by the graph below?

1. \((x-3)^2 + (y+1)^2 = 5\)
2. \((x+3)^2 + (y-1)^2 = 5\)
3. \((x-1)^2 + (y+3)^2 = 13\)
4. \((x+3)^2 + (y-1)^2 = 13\)
585 A circle with center $O$ and passing through the origin is graphed below.

What is the equation of circle $O$?

1. $x^2 + y^2 = 2\sqrt{5}$
2. $x^2 + y^2 = 20$
3. $(x + 4)^2 + (y - 2)^2 = 2\sqrt{5}$
4. $(x + 4)^2 + (y - 2)^2 = 20$
Algebra 2/Trigonometry Regents Exam Questions by Performance Indicator: Topic
Answer Section

1  ANS:  Controlled experiment because Howard is comparing the results obtained from an experimental sample against a control sample.

   PTS: 2      REF:  081030a2  STA:  A2.S.1  TOP:  Analysis of Data

2  ANS: 4      PTS: 2      REF:  011127a2  STA:  A2.S.1

   TOP:  Analysis of Data

3  ANS: 4      PTS: 2      REF:  061101a2  STA:  A2.S.1

   TOP:  Analysis of Data

4  ANS: 2      PTS: 2      REF:  061301a2  STA:  A2.S.1

   TOP:  Analysis of Data

5  ANS: 4      PTS: 2      REF:  011406a2  STA:  A2.S.1

   TOP:  Analysis of Data

6  ANS: 4  

   Students entering the library are more likely to spend more time studying, creating bias.

   PTS: 2      REF:  fall0904a2  STA:  A2.S.2  TOP:  Analysis of Data

7  ANS: 4      PTS: 2      REF:  011201a2  STA:  A2.S.2

   TOP:  Analysis of Data

8  ANS: 1      PTS: 2      REF:  061401a2  STA:  A2.S.2

   TOP:  Analysis of Data

9  ANS: 4      PTS: 2      REF:  011601a2  STA:  A2.S.2

   TOP:  Analysis of Data

10 ANS: 4     PTS: 2      REF:  061124a2  STA:  A2.S.3

   TOP:  Average Known with Missing Data

11 ANS: 4  

   \[
   \frac{4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + 4k + 2 \cdot 5}{4 + 6 + 10 + 0 + k + 2} = 2
   \]

   \[
   \frac{4k + 36}{k + 22} = 2
   \]

   \[
   4k + 36 = 2k + 44
   \]

   \[
   2k = 8
   \]

   \[
   k = 4
   \]

   PTS: 2      REF:  061221a2  STA:  A2.S.3  TOP:  Average Known with Missing Data
12 ANS: 3

13 ANS:

14 ANS:

\[ \sigma_x = 14.9, \bar{x} = 40. \text{ There are 8 scores between 25.1 and 54.9.} \]

15 ANS:

Ordered, the heights are 71, 71, 72, 74, 74, 75, 78, 79, 83. \( Q_1 = 72 \) and \( Q_3 = 79 \). \( 79 - 72 = 7 \).

16 ANS:

\[ \sigma_x \approx 6.2, 6 \text{ scores are within a population standard deviation of the mean. } Q_3 - Q_1 = 41 - 37 = 4 \]

\[ \bar{x} \approx 38.2 \]

17 ANS:

\[ Q_1 = 3.5 \text{ and } Q_3 = 10.5. \text{ } 10.5 - 3.5 = 7. \]

18 ANS: 2

\[ 12 - 7 = 5 \]
19 ANS: 
5.17  84.46 ± 5.17  
79.29 – 89.63  
5 + 7 + 5 = 17  
PTS: 4  REF: 061538a2  STA: A2.S.4  TOP: Dispersion  
KEY: advanced, group frequency distributions

20 ANS: 2  PTS: 2  REF: 081509a2  STA: A2.S.4  
TOP: Dispersion  KEY: basic, group frequency distributions

21 ANS: 3  PTS: 2  REF: 061127a2  STA: A2.S.6  
TOP: Regression

22 ANS:  
y = 2.001x^{2.298}, 1,009.  y = 2.001(15)^{2.298} \approx 1009  
PTS: 4  REF: fall0938a2  STA: A2.S.7  TOP: Power Regression

23 ANS:  
y = 10.596(1.586)^x  
PTS: 2  REF: 081031a2  STA: A2.S.7  TOP: Regression  
KEY: exponential

24 ANS:  
y = 27.2025(1.1509)^x  
y = 27.2025(1.1509)^{18} \approx 341  
PTS: 4  REF: 011238a2  STA: A2.S.7  TOP: Regression  
KEY: exponential

25 ANS:  
y = 180.377(0.954)^x  
PTS: 2  REF: 061231a2  STA: A2.S.7  TOP: Regression  
KEY: exponential

26 ANS:  
y = 215.983(1.652)^x  
215.983(1.652)^7 \approx 7250  
PTS: 4  REF: 011337a2  STA: A2.S.7  TOP: Regression  
KEY: exponential

27 ANS:  
y = 0.488(1.116)^x  
PTS: 2  REF: 061429a2  STA: A2.S.7  TOP: Regression  
KEY: exponential

28 ANS:  
y = 733.646(0.786)^x  
733.646(0.786)^{12} \approx 41  
PTS: 4  REF: 011536a2  STA: A2.S.7  TOP: Regression  
KEY: exponential
29 ANS:

\[ y = 2.19(3.23)^x \]

\[ 426.21 = 2.19(3.23)^x \]

\[ \frac{426.21}{2.19} = (3.23)^x \]

\[ \log\left(\frac{426.21}{2.19}\right) = x \log(3.23) \]

\[ \frac{\log(426.21)}{\log(3.23)} = x \]

\[ x \approx 4.5 \]

PTS: 4 REF: 011637a2 STA: A2.S.7 TOP: Exponential Regression

30 ANS: 2 PTS: 2 REF: 061021a2 STA: A2.S.8 TOP: Correlation Coefficient

31 ANS: 1

(4) shows the strongest linear relationship, but if \( r < 0 \), \( b < 0 \). The Regents announced that a correct solution was not provided for this question and all students should be awarded credit.

PTS: 2 REF: 011223a2 STA: A2.S.8 TOP: Correlation Coefficient

32 ANS: 1

\[
\begin{array}{|c|c|c|c|}
\hline
 L1 & L2 & L3 & X \\
\hline
 10 & 10 & 10 & 10 \\
 15 & 15 & 15 & 15 \\
 20 & 20 & 20 & 20 \\
\hline
\end{array}
\]

Lin Reg
\[ y = ax + b \]
\[ a = -6.642857143 \]
\[ b = 48.5357143 \]
\[ r = 0.9928686981 \]

33 ANS: 2

Since the coefficient of \( t \) is greater than 0, \( r > 0 \).

PTS: 2 REF: 061225a2 STA: A2.S.8 TOP: Correlation Coefficient

34 ANS: 1 PTS: 2 REF: 061316a2 STA: A2.S.8 TOP: Correlation Coefficient

35 ANS:

\[ r_A \approx 0.976 \quad r_B \approx 0.994 \]

Set \( B \) has the stronger linear relationship since \( r \) is higher.

PTS: 2 REF: 061535a2 STA: A2.S.8 TOP: Correlation Coefficient

36 ANS: 2 PTS: 2 REF: 081502a2 STA: A2.S.8 TOP: Correlation Coefficient

37 ANS: 3 PTS: 2 REF: 011616a2 STA: A2.S.8 TOP: Correlation Coefficient
38 ANS: 1

PTS: 2  REF: fall0915a2  STA: A2.S.5  TOP: Normal Distributions
KEY: interval

39 ANS: 3
68% × 50 = 34

PTS: 2  REF: 081013a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict

40 ANS:
68% of the students are within one standard deviation of the mean. 16% of the students are more than one standard deviation above the mean.

PTS: 2  REF: 011134a2  STA: A2.S.5  TOP: Normal Distributions
KEY: percent

41 ANS:
o. over 20 is more than 1 standard deviation above the mean. 0.159 · 82 ≈ 13.038

PTS: 2  REF: 061129a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict

42 ANS: 3
34.1% + 19.1% = 53.2%

PTS: 2  REF: 011212a2  STA: A2.S.5  TOP: Normal Distributions
KEY: probability

43 ANS: 2
\bar{x} ± \sigma
153 ± 22
131 – 175

PTS: 2  REF: 011307a2  STA: A2.S.5  TOP: Normal Distributions
KEY: interval

44 ANS: 2
Top 6.7% = 1.5 s.d. + \sigma = 1.5(104) + 576 = 732

PTS: 2  REF: 011420a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict
45 ANS: 
Less than 60 inches is below 1.5 standard deviations from the mean. \(0.067 \cdot 450 \approx 30\)

PTS: 2 \hspace{1cm} REF: 061428a2 \hspace{1cm} STA: A2.S.5 \hspace{1cm} TOP: Normal Distributions
KEY: predict

46 ANS:
\[
\text{sd} = \frac{81 - 57}{3} = 8
\]

\[
57 + 8 = 65
\]

\[
81 - 2(8) = 65
\]

PTS: 2 \hspace{1cm} REF: 011534a2 \hspace{1cm} STA: A2.S.5 \hspace{1cm} TOP: Normal Distributions
KEY: mean and standard deviation

47 ANS: 4
\[
\frac{91 - 82}{3.6} = 2.5 \text{ sd}
\]

PTS: 2 \hspace{1cm} REF: 081521a2 \hspace{1cm} STA: A2.S.5 \hspace{1cm} TOP: Normal Distributions
KEY: interval

48 ANS: 2
\[
\frac{60 - 50}{5} = 2 \text{ standards above the mean or } 2.3\% \hspace{0.5cm} 2.3\% \cdot 1000 = 23
\]

PTS: 2 \hspace{1cm} REF: 011614a2 \hspace{1cm} STA: A2.S.5 \hspace{1cm} TOP: Normal Distributions
KEY: predict

49 ANS: 4

PTS: 2 \hspace{1cm} REF: fall0925a2 \hspace{1cm} STA: A2.S.10
TOP: Permutations

50 ANS:
\[
\text{No. TENNESSEE: } \frac{9!}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780. \hspace{0.5cm} \text{VERMONT: } \frac{7!}{7} = 5,040
\]

PTS: 4 \hspace{1cm} REF: 061038a2 \hspace{1cm} STA: A2.S.10 \hspace{1cm} TOP: Permutations

51 ANS:
\[
39,916,800. \frac{12!}{3! \cdot 2!} = \frac{479,001,600}{12} = 39,916,800
\]

PTS: 2 \hspace{1cm} REF: 081035a2 \hspace{1cm} STA: A2.S.10 \hspace{1cm} TOP: Permutations

52 ANS: 1
\[
8 \times 8 \times 7 \times 1 = 448. \hspace{0.5cm} \text{The first digit cannot be 0 or 5. The second digit cannot be 5 or the same as the first digit.}
\hspace{0.5cm} \text{The third digit cannot be 5 or the same as the first or second digit.}
\]

PTS: 2 \hspace{1cm} REF: 011125a2 \hspace{1cm} STA: A2.S.10 \hspace{1cm} TOP: Permutations
53 ANS: 1
\[ \frac{6!}{3!2!} = \frac{720}{12} = 60 \]

PTS: 2 REF: 011324a2 STA: A2.S.10 TOP: Permutations

54 ANS:
\[ \frac{10!}{3!3!2!} = \frac{3,628,800}{72} = 50,400 \]

PTS: 2 REF: 061330a2 STA: A2.S.10 TOP: Permutations

55 ANS: 4 PTS: 2 REF: 011409a2 STA: A2.S.10

TOP: Permutations

56 ANS: 3
\[ 2!2!2!2! = 8 \]

PTS: 2 REF: 061425a2 STA: A2.S.10 TOP: Permutations

57 ANS: 1
\[ \frac{11!}{2!2!2!} = \frac{39,916,800}{16} = 2,494,800 \]

PTS: 2 REF: 011518a2 STA: A2.S.10 TOP: Permutations

58 ANS: 1
\[ \frac{4!}{2!2!} = \frac{362,880}{96} = 3,780 \]

PTS: 2 REF: 061511a2 STA: A2.S.10 TOP: Permutations

59 ANS: 1
\[ \frac{11!}{3!2!2!} = \frac{39,916,800}{48} = 831,600 \]

PTS: 2 REF: 081512a2 STA: A2.S.10 TOP: Permutations

60 ANS:
\[ \frac{11!}{3!2!2!} = 1,663,200 \]

PTS: 2 REF: 011631a2 STA: A2.S.10 TOP: Permutations

61 ANS: 2
\[ \binom{15}{8} = 6,435 \]

PTS: 2 REF: 081012a2 STA: A2.S.11 TOP: Combinations

62 ANS: 1
\[ \binom{10}{4} = 210 \]

PTS: 2 REF: 061113a2 STA: A2.S.11 TOP: Combinations
63. Ans: 
\[ \binom{25}{20} = 53,130 \]

Pts: 2  Ref: 011232a2  Sta: A2.S.11  Top: Combinations

64. Ans: 4
\[ \binom{15}{3} = 3,003. \quad \binom{25}{5} = \binom{25}{20} = 53,130. \quad \binom{25}{15} = 3,268,760. \]

Pts: 2  Ref: 061227a2  Sta: A2.S.11  Top: Combinations

65. Ans: 3
\[ \binom{20}{4} = 4,845 \]

Pts: 2  Ref: 011509a2  Sta: A2.S.11  Top: Combinations

66. Ans: 3
\[ \binom{9}{3} = 84 \]

Pts: 2  Ref: 081513a2  Sta: A2.S.11  Top: Combinations

67. Ans: 3  Pts: 2  Ref: 061007a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

68. Ans: 1  Pts: 2  Ref: 011117a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

69. Ans: 1  Pts: 2  Ref: 011310a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

70. Ans: 1  Pts: 2  Ref: 061317a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

71. Ans: 2  Pts: 2  Ref: 011417a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

72. Ans: 3  Pts: 2  Ref: 061523a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

73. Ans: 4  Pts: 2  Ref: 081526a2  Sta: A2.S.9  Top: Differentiating Permutations and Combinations

74. Ans: 
\[ \binom{9}{3} \times 2 \times \binom{20}{3} = 41,040 \]

Pts: 2  Ref: fall0935a2  Sta: A2.S.12  Top: Sample Space

75. Ans: 3
\[ \binom{3}{1} \times \binom{5}{2} = 3 \cdot 10 = 30 \]

Pts: 2  Ref: 061422a2  Sta: A2.S.12  Top: Combinations
\[
\frac{\pi}{3} + \frac{\pi}{3} = \frac{2\pi}{2\pi} = \frac{1}{3}
\]

76 ANS: 2

77 ANS:
\[
0.167 = C_8^1 \cdot 0.6^8 \cdot 0.4^2 + C_9^1 \cdot 0.6^9 \cdot 0.4^1 + C_{10}^1 \cdot 0.6^{10} \cdot 0.4^0 \approx 0.167
\]

78 ANS:
\[
26.2\% = C_8^1 \cdot 0.65^8 \cdot 0.35^2 + C_9^1 \cdot 0.65^9 \cdot 0.35^1 + C_{10}^1 \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262
\]

79 ANS:
\[
0.468 = C_6^1 \left(\frac{2}{3}\right)^6 \left(\frac{1}{3}\right)^2 \approx 0.27313; C_7^1 \left(\frac{2}{3}\right)^7 \left(\frac{1}{3}\right)^1 \approx 0.15607; C_8^1 \left(\frac{2}{3}\right)^8 \left(\frac{1}{3}\right)^0 \approx 0.03902.
\]

80 ANS:
\[
\frac{51}{243} = C_3^1 \left(\frac{1}{3}\right)^3 \left(\frac{2}{3}\right)^2 = \frac{40}{243}
\]
\[
= C_3^1 \left(\frac{1}{3}\right)^4 \left(\frac{2}{3}\right)^1 = \frac{10}{243}
\]
\[
= C_3^1 \left(\frac{1}{3}\right)^5 \left(\frac{2}{3}\right)^0 = \frac{1}{243}
\]
81 ANS: 4
\[ \binom{5}{8} \binom{3}{8} = \frac{225}{512} \]

PTS: 2 REF: 011221a2 STA: A2.S.15 TOP: Binomial Probability
KEY: spinner

82 ANS: 1

TOP: Binomial Probability KEY: modeling

83 ANS:
\[ \binom{\frac{1}{4}}{3} \left( \frac{3}{4} \right)^4 = 35 \left( \frac{1}{64} \right) \left( \frac{81}{256} \right) = \frac{2835}{16384} \approx 0.173 \]

PTS: 2 REF: 061335a2 STA: A2.S.15 TOP: Binomial Probability
KEY: exactly

84 ANS:
\[ 5 \cdot 0.28^4 \cdot 0.72^1 + 5 \cdot 0.28^5 \cdot 0.72^0 \approx 0.024 \]

PTS: 4 REF: 011437a2 STA: A2.S.15 TOP: Binomial Probability
KEY: at least or at most

85 ANS:
\[ 5 \cdot 0.57^0 \cdot 0.43^5 + 5 \cdot 0.57^1 \cdot 0.43^4 + 5 \cdot 0.57^2 \cdot 0.43^3 \approx 0.37 \]

KEY: at least or at most

86 ANS:
\[ 6 \cdot \binom{\frac{2}{5}}{3} = 6 \left( \frac{32}{3125} \right) \left( \frac{3}{5} \right) = \frac{576}{15,625} \]

PTS: 2 REF: 011532a2 STA: A2.S.15 TOP: Binomial Probability
KEY: exactly

87 ANS:
\[ \binom{\frac{1}{4}}{1} \binom{\frac{3}{4}}{2} = 3 \cdot \frac{1}{4} \cdot \frac{9}{16} = \frac{27}{64} \]

PTS: 2 REF: 061530a2 STA: A2.S.15 TOP: Binomial Probability
KEY: exactly

88 ANS:
\[ \binom{\frac{2}{3}}{3} \left( \frac{1}{3} \right)^3 = 35 \left( \frac{16}{81} \right) \left( \frac{1}{27} \right) = \frac{560}{2187} \]

PTS: 2 REF: 081531a2 STA: A2.S.15 TOP: Binomial Probability
KEY: exactly

89 ANS: 4

TOP: Binomial Probability KEY: modeling
90 ANS: 1

\[ 4a + 6 = 4a - 10. \quad 4a + 6 = -4a + 10. \quad \left| 4 \left( \frac{1}{2} \right) + 6 \right| - 4 \left( \frac{1}{2} \right) = -10 \]

\[ 6 \neq -10 \quad 8a = 4 \quad 8 - 2 \neq -10 \]

\[ a = \frac{4}{8} = \frac{1}{2} \]

PTS: 2 REF: 011106a2 STA: A2.A.1 TOP: Absolute Value Equations

91 ANS: 2

\[ x - 2 = 3x + 10 - 6 \text{ is extraneous.} \quad x - 2 = -3x - 10 \]

\[ -12 = 2x \quad 4x = -8 \]

\[ -6 = x \quad x = -2 \]

PTS: 2 REF: 061513a2 STA: A2.A.1 TOP: Absolute Value Equations

92 ANS: 1

\[ 6x - 7 \leq 5 \quad 6x - 7 \geq -5 \]

\[ 6x \leq 12 \quad 6x \geq 2 \]

\[ x \leq 2 \quad x \geq \frac{1}{3} \]

PTS: 2 REF: fall0905a2 STA: A2.A.1 TOP: Absolute Value Inequalities

KEY: graph

93 ANS:

\[ -3|6 - x| < -15 \quad \left| 6 - x \right| > 5 \]

\[ 6 - x > 5 \text{ or } 6 - x < -5 \]

\[ 1 > x \text{ or } 11 < x \]

PTS: 2 REF: 061137a2 STA: A2.A.1 TOP: Absolute Value Inequalities

KEY: graph

94 ANS: 3

\[ \frac{4x - 5}{3} > 1 \text{ or } \frac{4x - 5}{3} < -1 \]

\[ 4x - 5 > 3 \quad 4x - 5 < -3 \]

\[ 4x > 8 \quad 4x < 2 \]

\[ x > 2 \quad x < \frac{1}{2} \]

PTS: 2 REF: 061209a2 STA: A2.A.1 TOP: Absolute Value Inequalities

KEY: graph
95 ANS:
\[ 3 - 2x \geq 7 \text{  or  } 3 - 2x \leq -7 \]
\[ -2x \geq 4 \quad -2x \leq -10 \]
\[ x \leq -2 \quad x \geq 5 \]

PTS: 2 REF: 011334a2 STA: A2.A.1 TOP: Absolute Value Inequalities
KEY: graph

96 ANS: 1
\[ 2x - 1 > 5, \ 2x - 1 < -5 \]
\[ 2x > 6 \quad 2x > -4 \]
\[ x > 3 \quad x < -2 \]

PTS: 2 REF: 061307a2 STA: A2.A.1 TOP: Absolute Value Inequalities
KEY: graph

97 ANS:
\[ -4x + 5 < 13 \quad -4x + 5 > -13 \quad -2 < x < 4.5 \]
\[ -4x < 8 \quad -4x > -18 \]
\[ x > -2 \quad x < 4.5 \]

PTS: 2 REF: 011432a2 STA: A2.A.1 TOP: Absolute Value Inequalities

98 ANS:
\[ 2x - 3 > 5 \text{  or  } 2x - 3 < -5 \]
\[ 2x > 8 \quad 2x < -2 \]
\[ x > 4 \quad x < -1 \]

PTS: 2 REF: 061430a2 STA: A2.A.1 TOP: Absolute Value Inequalities

99 ANS:
\[ |3x - 5| < x + 17 \quad 3x - 5 < x + 17 \text{  and  } 3x - 5 > -x - 17 \quad -3 < x < 11 \]
\[ 2x < 22 \quad 4x > -12 \]
\[ x < 11 \quad x > -3 \]

PTS: 4 REF: 081538a2 STA: A2.A.1 TOP: Absolute Value Inequalities

100 ANS: 2
\[ 4|2x + 6| < 32, \ 2x + 6 < 8, \ 2x + 6 > -8 \]
\[ |2x + 6| < 8 \quad 2x < 2 \quad 2x > -14 \]
\[ x < 1 \quad x > -7 \]

PTS: 2 REF: 011612a2 STA: A2.A.1 TOP: Absolute Value Inequalities
KEY: graph
101 ANS:
\[
\text{Sum } \frac{-b}{a} = \frac{-11}{5}. \quad \text{Product } \frac{c}{a} = \frac{-3}{5}
\]

PTS: 2
REF: 061030a2
STA: A2.A.20
TOP: Roots of Quadratics

102 ANS: 2
\[
\text{sum: } \frac{-b}{a} = \frac{4}{6} = \frac{2}{3}, \quad \text{product: } \frac{c}{a} = \frac{-12}{6} = -2
\]

PTS: 2
REF: 011209a2
STA: A2.A.20
TOP: Roots of Quadratics

103 ANS:
\[
3x^2 - 11x + 6 = 0. \quad \text{Sum } \frac{-b}{a} = \frac{11}{3}. \quad \text{Product } \frac{c}{a} = \frac{6}{3} = 2
\]

PTS: 2
REF: 011329a2
STA: A2.A.20
TOP: Roots of Quadratics

104 ANS:
\[
\text{Sum } \frac{-b}{a} = \frac{-1}{12}. \quad \text{Product } \frac{c}{a} = \frac{-1}{2}
\]

PTS: 2
REF: 061328a2
STA: A2.A.20
TOP: Roots of Quadratics

105 ANS: 4
\[
2x^2 - 7x - 5 = 0
\]
\[
\frac{c}{a} = \frac{-5}{2}
\]

PTS: 2
REF: 061414a2
STA: A2.A.20
TOP: Roots of Quadratics

106 ANS: 3
\[
\frac{c}{a} = \frac{-3}{4}
\]

PTS: 2
REF: 011517a2
STA: A2.A.20
TOP: Roots of Quadratics

107 ANS:
\[
\text{Sum } \frac{-b}{a} = \frac{-2}{3}. \quad \text{Product } \frac{c}{a} = \frac{k}{3}
\]

PTS: 2
REF: 061534a2
STA: A2.A.20
TOP: Roots of Quadratics

108 ANS: 2
\[
P = \frac{c}{a} = \frac{-12}{3} = -4
\]

PTS: 2
REF: 081506a2
STA: A2.A.20
TOP: Roots of Quadratics

109 ANS: 2
\[
\frac{-b}{a} = \frac{-6}{-3} = 2
\]

PTS: 2
REF: 011613a2
STA: A2.A.20
TOP: Roots of Quadratics
110  ANS: 3
\[ S = \frac{-b}{a} = \frac{-(3)}{4} = \frac{3}{4}, \quad P = \frac{c}{a} = \frac{-8}{4} = -2 \]

PTS: 2   REF: fall0912a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic

111  ANS: 3
\[ \frac{-b}{a} = \frac{-6}{2} = -3, \quad \frac{c}{a} = \frac{4}{2} = 2 \]

PTS: 2   REF: 011121a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic

112  ANS:
\[ x^2 - 6x - 27 = 0, \quad \frac{-b}{a} = 6, \quad \frac{c}{a} = -27. \text{ If } a = 1 \text{ then } b = -6 \text{ and } c = -27 \]

PTS: 4   REF: 061130a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic

113  ANS: 3
sum of the roots, \[ \frac{-b}{a} = \frac{-(9)}{4} = \frac{9}{4} \]
product of the roots, \[ \frac{c}{a} = \frac{3}{4} \]

PTS: 2   REF: 061208a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic

114  ANS: 3
\[ \frac{-b}{a} = \frac{-(4)}{1} = 4. \text{ If the sum is 4, the roots must be 7 and } -3. \]

PTS: 2   REF: 011418a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: advanced

115  ANS: 4
\[ 6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2) \]

PTS: 2   REF: fall0917a2   STA: A2.A.7   TOP: Factoring Polynomials
KEY: single variable

116  ANS: 4
\[ 12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2) \]

PTS: 2   REF: 061008a2   STA: A2.A.7   TOP: Factoring Polynomials
KEY: single variable

117  ANS:
\[ 10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5) \]

PTS: 2   REF: 081028a2   STA: A2.A.7   TOP: Factoring Polynomials
KEY: multiple variables
118 ANS:
\[12t^8 - 75t^4 = 3t^4(4t^4 - 25) = 3t^4(2t^2 + 5)(2t^2 - 5)\]

PTS: 2  REF: 061133a2  STA: A2.A.7  TOP: Factoring the Difference of Perfect Squares

119 ANS: 2
\[x^3 + 3x^2 - 4x - 12\]
\[x^2(x + 3) - 4(x + 3)\]
\[(x^2 - 4)(x + 3)\]
\[(x + 2)(x - 2)(x + 3)\]

PTS: 2  REF: 061214a2  STA: A2.A.7  TOP: Factoring by Grouping

120 ANS: 3
\[3x^3 - 5x^2 - 48x + 80\]
\[x^2(3x - 5) - 16(3x - 5)\]
\[(x^2 - 16)(3x - 5)\]
\[(x + 4)(x - 4)(3x - 5)\]

PTS: 2  REF: 011317a2  STA: A2.A.7  TOP: Factoring by Grouping

121 ANS: 4
\[x^2(x + 2) - (x + 2)\]
\[(x^2 - 1)(x + 2)\]
\[(x + 1)(x - 1)(x + 2)\]

PTS: 2  REF: 011426a2  STA: A2.A.7  TOP: Factoring by Grouping

122 ANS: 2
\[x^3 - 2x^2 - 9x + 18\]
\[x^2(x - 2) - 9(x - 2)\]
\[(x^2 - 9)(x - 2)\]
\[(x + 3)(x - 3)(x - 2)\]

PTS: 2  REF: 011511a2  STA: A2.A.7  TOP: Factoring by Grouping

123 ANS:
\[x^2(x - 6) - 25(x - 6)\]
\[(x^2 - 25)(x - 6)\]
\[(x + 5)(x - 5)(x - 6)\]

PTS: 2  REF: 061532a2  STA: A2.A.7  TOP: Factoring by Grouping
124 ANS:

\[ x^2(x + 3) + 2(x + 3) = (x^2 + 2)(x + 3) \]

PTS: 2   REF: 011629a2   STA: A2.A.7   TOP: Factoring by Grouping

125 ANS: 4

\[ \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} = \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 3\sqrt{5}}{2} \]

PTS: 2   REF: 061009a2   STA: A2.A.25   TOP: Quadratics with Irrational Solutions

126 ANS: 3

\[ \frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)} = -\frac{7 \pm \sqrt{73}}{4} \]

PTS: 2   REF: 081009a2   STA: A2.A.25   TOP: Solving Quadratics

KEY: quadratic formula

127 ANS:

\[ \frac{2 \pm \sqrt{(-2)^2 - 4(6)(-3)}}{2(6)} = \frac{2 \pm \sqrt{76}}{12} = \frac{2 \pm \sqrt{4 \cdot 19}}{12} = \frac{2 \pm 2\sqrt{19}}{12} = \frac{1 \pm \sqrt{19}}{6} \]

PTS: 2   REF: 011332a2   STA: A2.A.25   TOP: Solving Quadratics

KEY: quadratic formula

128 ANS: 2

\[ 60 = -16r^2 + 5t + 105 \quad t = \frac{-5 \pm \sqrt{5^2 - 4(-16)(45)}}{2(-16)} \approx \frac{-5 \pm 53.89}{-32} \approx 1.84 \]

\[ 0 = -16r^2 + 5t + 45 \]

PTS: 2   REF: 061424a2   STA: A2.A.25   TOP: Solving Quadratics

KEY: quadratic formula

129 ANS:

\[ (x + 14)(x + 22) = 800 \quad x = \frac{-36 \pm \sqrt{(36)^2 - 4(1)(-492)}}{2(1)} = \frac{-36 + \sqrt{3264}}{2} \approx 10.6 \quad 10 \text{ feet increase.} \]

\[ x^2 + 36x + 308 = 800 \]

\[ x^2 + 36x - 492 = 0 \]

PTS: 6   REF: 011539a2   STA: A2.A.25   TOP: Solving Quadratics

KEY: quadratic formula
130 ANS:
\[ b^2 - 4ac = 0 \]
\[ k^2 - 4(1)(4) = 0 \]
\[ k^2 - 16 = 0 \]
\[ (k + 4)(k - 4) = 0 \]
\[ k = \pm 4 \]

PTS: 2  REF: 061028a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine equation given nature of roots

131 ANS: 4
\[ b^2 - 4ac = 3^2 - 4(9)(-4) = 9 + 144 = 153 \]

PTS: 2  REF: 081016a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine nature of roots given equation

132 ANS: 3
\[ b^2 - 4ac = (-10)^2 - 4(1)(25) = 100 - 100 = 0 \]

PTS: 2  REF: 011102a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine nature of roots given equation

133 ANS: 4  PTS: 2  REF: 011323a2  STA: A2.A.2
TOP: Using the Discriminant  KEY: determine nature of roots given equation

134 ANS: 2
\[ b^2 - 4ac = (-9)^2 - 4(2)(4) = 81 - 32 = 49 \]

PTS: 2  REF: 011411a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine nature of roots given equation

135 ANS: 3
\[ (-5)^2 - 4(2)(0) = 25 \]

PTS: 2  REF: 061423a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine equation given nature of roots

136 ANS: 2
\[ (-5)^2 - 4(1)(4) = 9 \]

PTS: 2  REF: 011506a2  STA: A2.A.2  TOP: Using the Discriminant

137 ANS: 3
\[ 3x^2 + x - 14 = 0 \]
\[ 1^2 - 4(3)(-14) = 1 + 168 = 169 = 13^2 \]

PTS: 2  REF: 061524a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine nature of roots given equation
138 ANS: 4
\[ 4x^2 + 3x - 4 = 0 \quad b^2 - 4ac = 3^2 - 4(4)(-4) = 9 + 64 = 73 \]

PTS: 2 REF: 011618a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine nature of roots given equation

139 ANS:
\[ 3 \pm \sqrt{7}. \quad 2x^2 - 12x + 4 = 0 \]
\[ x^2 - 6x + 2 = 0 \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]
\[ x - 3 = \pm \sqrt{7} \]
\[ x = 3 \pm \sqrt{7} \]

PTS: 4 REF: fall0936a2 STA: A2.A.24 TOP: Solving Quadratics
KEY: completing the square

140 ANS: 2
\[ x^2 + 2 = 6x \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]

PTS: 2 REF: 011116a2 STA: A2.A.24 TOP: Solving Quadratics
KEY: completing the square

141 ANS: 2

PTS: 2 REF: 061122a2 STA: A2.A.24

TOP: Solving Quadratics
KEY: completing the square

142 ANS: 2
\[ (x + 2)^2 = -9 \]
\[ x + 2 = \pm \sqrt{-9} \]
\[ x = -2 \pm 3i \]

PTS: 2 REF: 011408a2 STA: A2.A.24 TOP: Solving Quadratics
KEY: completing the square

143 ANS: 1

PTS: 2 REF: 061408a2 STA: A2.A.24

TOP: Solving Quadratics
KEY: completing the square
144 ANS: 3
\[ x^2 = 12x - 7 \]
\[ x^2 - 12x = -7 \]
\[ x^2 - 12x + 36 = -7 + 36 \]
\[ (x - 6)^2 = 29 \]

PTS: 2 REF: 061505a2 STA: A2.A.24 TOP: Solving Quadratics
KEY: completing the square

145 ANS: 1
\[ \left( \frac{1}{2} \left( \frac{1}{4} \right) \right)^2 = \frac{1}{64} \]

PTS: 2 REF: 081527a2 STA: A2.A.24 TOP: Solving Quadratics
KEY: completing the square

146 ANS:
\[ x^2 + 10x + 25 = 8 + 25 \]
\[ (x + 5)^2 = 33 \]
\[ x + 5 = \pm \sqrt{33} \]
\[ x = -5 \pm \sqrt{33} \]

PTS: 4 REF: 011636a2 STA: A2.A.24 TOP: Completing the Square

147 ANS: 1
\[ y \geq x^2 - x - 6 \]
\[ y \geq (x - 3)(x + 2) \]

PTS: 2 REF: 061017a2 STA: A2.A.4 TOP: Quadratic Inequalities
KEY: two variables

148 ANS: 3
\[ x^2 - 3x - 10 > 0 \] or
\[ (x - 5)(x + 2) > 0 \]
\[ x - 5 < 0 \text{ and } x + 2 < 0 \]
\[ x - 5 > 0 \text{ and } x + 2 > 0 \]
\[ x > 5 \text{ and } x > -2 \]
\[ x > 5 \text{ and } x > -2 \]
\[ x < -2 \]
\[ x > 5 \]

PTS: 2 REF: 011115a2 STA: A2.A.4 TOP: Quadratic Inequalities
KEY: one variable
149 ANS:
\[ x < -1 \text{ or } x > 5. \quad x^2 - 4x - 5 > 0. \quad x - 5 > 0 \text{ and } x + 1 > 0 \text{ or } x - 5 < 0 \text{ and } x + 1 < 0 \]
\[ (x - 5)(x + 1) > 0 \quad x > 5 \text{ and } x > -1 \quad x < 5 \text{ and } x < -1 \]
\[ x > 5 \quad x = -1 \]

PTS: 2  REF: 011228a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable

150 ANS: 2
\[ 9 - x^2 < 0 \quad \text{or } x + 3 < 0 \text{ and } x - 3 < 0 \]
\[ x^2 - 9 > 0 \quad x < -3 \text{ and } x < 3 \]
\[ (x + 3)(x - 3) > 0 \quad x < -3 \]
\[ x + 3 > 0 \text{ and } x - 3 > 0 \]
\[ x > -3 \text{ and } x > 3 \]
\[ x > 3 \]

PTS: 2  REF: 061507a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable

151 ANS: 2
\[ x^2 - x - 6 = 3x - 6 \]
\[ x^2 - 4x = 0 \]
\[ x(x - 4) = 0 \]
\[ x = 0, 4 \]

PTS: 2  REF: 081015a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: algebraically

152 ANS:
\[ \left\{ \frac{9}{2}, \frac{1}{2} \right\} \text{ and } \left\{ \frac{11}{2}, \frac{11}{2} \right\} \]
\[ y = x + 5 \quad 4x^2 + 17x - 4 = x + 5 \]
\[ y = 4x^2 + 17x - 4 \quad 4x^2 + 16x - 9 = 0 \]
\[ (2x + 9)(2x - 1) = 0 \]
\[ x = -\frac{9}{2} \text{ and } x = \frac{1}{2} \]
\[ y = -\frac{9}{2} + 5 = \frac{1}{2} \text{ and } y = \frac{1}{2} + 5 = \frac{11}{2} \]

PTS: 6  REF: 061139a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: algebraically
153 ANS: 3

\[ x + y = 5 \quad \text{and} \quad -5 + y = 5 \]
\[ y = -x + 5 \quad y = 10 \]
\[ (x + 3)^2 + (-x + 5 - 3)^2 = 53 \]
\[ x^2 + 6x + 9 + x^2 - 4x + 4 = 53 \]
\[ 2x^2 + 2x - 40 = 0 \]
\[ x^2 + x - 20 = 0 \]
\[ (x + 5)(x - 4) = 0 \]
\[ x = -5, 4 \]

PTS: 2 REF: 011302a2 STA: A2.A.3 TOP: Quadratic-Linear Systems
KEY: circle

154 ANS: 4

\[ x = 3y \quad y^2 - (3y)^2 + 32 = 0 \quad x = 3(-2) = -6 \]
\[ y^2 - 9y^2 = -32 \]
\[ -8y^2 = -32 \]
\[ y^2 = 4 \]
\[ y = \pm 2 \]

PTS: 2 REF: 061312a2 STA: A2.A.3 TOP: Quadratic-Linear Systems
KEY: equations

155 ANS:

\[ x(x + 3) = 10 \]
\[ x^2 + 3x - 10 = 0 \]
\[ (x + 5)(x - 2) = 0 \]
\[ x = -5, 2 \]

PTS: 2 REF: 011431a2 STA: A2.A.3 TOP: Quadratic-Linear Systems
KEY: equations
156 ANS: 2
\[ 2x^2 - (x + 2)^2 = 8 \]
\[ 2x^2 - (x^2 + 4x + 4) - 8 = 0 \]
\[ x^2 - 4x - 12 = 0 \]
\[ (x - 6)(x + 2) = 0 \]
\[ x = 6, -2 \]

PTS: 2 | REF: 011609a2 | STA: A2.A.3 | TOP: Quadratic-Linear Systems
KEY: equations

157 ANS:
\[ \frac{4}{9}x^2 - \frac{4}{3}x + 1 \cdot \left( \frac{2}{3}x - 1 \right)^2 = \left( \frac{2}{3}x - 1 \right) \left( \frac{2}{3}x - 1 \right) = \frac{4}{9}x^2 - \frac{2}{3}x - \frac{2}{3}x + 1 = \frac{4}{9}x^2 - \frac{4}{3}x + 1 \]

PTS: 2 | REF: 081034a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: multiplication

159 ANS:
\[ 6y^3 - \frac{37}{10}y^2 - \frac{1}{3}y \cdot \left( \frac{1}{2}y^2 - \frac{1}{3}y \right) \left( 12y + \frac{3}{5} \right) = 6y^3 + \frac{3}{10}y^2 - 4y^2 - \frac{1}{3}y = 6y^3 - \frac{37}{10}y^2 - \frac{1}{3}y \]

PTS: 2 | REF: 061128a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: subtraction

160 ANS: 2
The binomials are conjugates, so use FL.

PTS: 2 | REF: 011206a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: multiplication

161 ANS: 1
The binomials are conjugates, so use FL.

PTS: 2 | REF: 061201a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: multiplication

162 ANS: 1
\[ \left( \frac{3}{2}x - 1 \right) \left( \frac{3}{2}x + 1 \right) - \left( \frac{3}{2}x - 1 \right) = \left( \frac{3}{2}x - 1 \right)(2) = 3x - 2 \]

PTS: 2 | REF: 011524a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: subtraction

163 ANS: 4
The binomials are conjugates, so use FL.

PTS: 2 | REF: 011314a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: subtraction

164 ANS: 3
\[ \left( \frac{3}{2}x - 1 \right) \left( \frac{3}{2}x + 1 \right) - \left( \frac{3}{2}x - 1 \right) = \left( \frac{3}{2}x - 1 \right)(2) = 3x - 2 \]

PTS: 2 | REF: 061515a2 | STA: A2.N.3 | TOP: Operations with Polynomials
KEY: subtraction
\[
\frac{2}{3} x^3 + \frac{11}{8} x^2 - \frac{7}{9} x - \frac{2}{9}
\]

PTS: 2  REF: 011635a2  STA: A2.N.3  TOP: Operations with Polynomials

KEY: subtraction

\[
\frac{3^{-2}}{(-2)^{-3}} = \frac{\frac{1}{9}}{\frac{1}{8}} = \frac{8}{9}
\]

PTS: 2  REF: 061003a2  STA: A2.N.1  TOP: Negative and Fractional Exponents

\[6n^{-1} < 4n^{-1}\]  Flip sign when multiplying each side of the inequality by \(n\), since a negative number.

\[\frac{6}{n} < \frac{4}{n}\]

\[6 > 4\]

PTS: 2  REF: 061314a2  STA: A2.N.1  TOP: Negative and Fractional Exponents

\[
f(16) = 4(16)^{\frac{1}{2}} + 16^{0} + 16^{\frac{1}{4}}
\]

\[= 4(4) + 1 + \frac{1}{2}\]

\[= 17 \frac{1}{2}\]

PTS: 2  REF: 081503a2  STA: A2.N.1  TOP: Negative and Fractional Exponents

\[
\left(\frac{w^{-5}}{w^{-y}}\right)^{\frac{1}{2}} = (w^4)^{\frac{1}{2}} = w^2
\]

PTS: 2  REF: 081011a2  STA: A2.A.8  TOP: Negative and Fractional Exponents

170  ANS: 1  PTS: 2  REF: 011306a2  STA: A2.A.8  TOP: Negative and Fractional Exponents

171  ANS: 1  PTS: 2  REF: 011402a2  STA: A2.A.8  TOP: Negative and Fractional Exponents

172  ANS: 4  PTS: 2  REF: 061402a2  STA: A2.A.8  TOP: Negative and Fractional Exponents

173  ANS: 1  PTS: 2  REF: fall0914a2  STA: A2.A.9  TOP: Negative and Fractional Exponents
174 ANS: 2

\[
\frac{x^{-1} - 1}{x - 1} = \frac{\frac{1}{x} - 1}{x - 1} = \frac{\frac{1-x}{x}}{x - 1} = \frac{x}{x - 1} = \frac{1}{x}
\]

PTS: 2    REF: 081018a2    STA: A2.A.9    TOP: Negative Exponents

175 ANS:

\[
\frac{12x^2}{y^9} \cdot \frac{3x^{-4}y^5}{(2x^3y^{-7})^2} = \frac{3y^5(2x^3y^{-7})^2}{x^4} = \frac{3y^5(4x^6y^{-14})}{x^4} = \frac{12x^2y^{-9}}{y^9} = 12x^2
\]

PTS: 2    REF: 061134a2    STA: A2.A.9    TOP: Negative Exponents

176 ANS: 2

\[
\frac{x^{-1} + 1}{x + 1} = \frac{\frac{1}{x} + 1}{x + 1} = \frac{\frac{1+x}{x}}{x + 1} = \frac{1}{x}
\]

PTS: 2    REF: 011211a2    STA: A2.A.9    TOP: Negative Exponents

177 ANS: 1    PTS: 2    REF: 061210a2    STA: A2.A.9    TOP: Negative Exponents

178 ANS: 1    PTS: 2    REF: 061324a2    STA: A2.A.9    TOP: Negative Exponents

179 ANS: 2

\[
5^2a^{-3}b^4 = \frac{25a^4}{a^3}
\]

PTS: 2    REF: 011514a2    STA: A2.A.9    TOP: Negative Exponents

180 ANS: 4    PTS: 2    REF: 061506a2    STA: A2.A.9    TOP: Negative Exponents

181 ANS:

\[
2,298.65
\]

PTS: 2    REF: fall0932a2    STA: A2.A.12    TOP: Evaluating Exponential Expressions

182 ANS:

\[
e^{3\ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8
\]

PTS: 2    REF: 061131a2    STA: A2.A.12    TOP: Evaluating Exponential Expressions

183 ANS:

\[
A = 750e^{0.03(8)} \approx 953
\]

PTS: 2    REF: 061229a2    STA: A2.A.12    TOP: Evaluating Exponential Expressions
\[ 5000 \left(1 + \frac{0.03}{4}\right)^{4 \cdot 5} = 5000(1.0075)^{20} \approx 5805.92 \]

PTS: 2  REF: 011410a2  STA: A2.A.12  TOP: Evaluating Functions

185  ANS: 3  PTS: 2  REF: 061416a2  STA: A2.A.12
TOP: Evaluating Exponential Expressions

\[ p(5) - p(0) = 17(1.15)^{2(5)} - 17(1.15)^{2(0)} \approx 68.8 - 17 \approx 51 \]

PTS: 2  REF: 061527a2  STA: A2.A.12  TOP: Functional Notation

187  ANS: 2
\[ A = 50 \left(1 + \frac{0.0325}{4}\right)^{4 \cdot 12} = 50(1.008125)^{48} \approx 73.73 \]

PTS: 2  REF: 081511a2  STA: A2.A.12  TOP: Evaluating Functions

188  ANS: 4
\[ A = 5000e^{0.04(18)} \approx 10272.17 \]

PTS: 2  REF: 011607a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

189  ANS: 2
\[ 8^2 = 64 \]

PTS: 2  REF: fall0909a2  STA: A2.A.18  TOP: Evaluating Logarithmic Expressions

190  ANS: 4  PTS: 2  REF: 011124a2  STA: A2.A.18
TOP: Evaluating Logarithmic Expressions

191  ANS:

\[ y = 0 \]

PTS: 2  REF: 061031a2  STA: A2.A.53  TOP: Graphing Exponential Functions
Graphing Exponential Functions
Algebra 2/Trigonometry Regents Exam Questions by Performance Indicator: Topic
Answer Section

193 ANS: 1 PTS: 2 REF: 011505a2 STA: A2.A.53
TOP: Graphing Exponential Functions

194 ANS: 2
\[ f^{-1}(x) = \log_4 x \]

PTS: 2 REF: fall0916a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

195 ANS: 1 PTS: 2 REF: 061211a2 STA: A2.A.54
TOP: Graphing Logarithmic Functions

196 ANS: 3 PTS: 2 REF: 011422a2 STA: A2.A.54
TOP: Graphing Logarithmic Functions

197 ANS: 1

\[
2 \log x - (3 \log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3z}
\]

PTS: 2 REF: 061010a2 STA: A2.A.19 TOP: Properties of Logarithms

198 ANS: 4 PTS: 2 REF: 061120a2 STA: A2.A.19
TOP: Properties of Logarithms KEY: splitting logs

199 ANS: 2

\[
\log x^2 = \log 3a + \log 2a
\]

\[ 2 \log x = \log 6a^2 \]

\[
\log x = \frac{\log 6}{2} + \frac{\log a^2}{2}
\]

\[
\log x = \frac{1}{2} \log 6 + \frac{2 \log a}{2}
\]

\[
\log x = \frac{1}{2} \log 6 + \log a
\]

KEY: splitting logs

200 ANS: 4 PTS: 2 REF: 061207a2 STA: A2.A.19
TOP: Properties of Logarithms KEY: antilogarithms
201 ANS: 2
\[ \log 9 - \log 20 \]
\[ \log 3^2 - \log (10 \cdot 2) \]
\[ 2 \log 3 - (\log 10 + \log 2) \]
\[ 2b - (1 + a) \]
\[ 2b - a - 1 \]

KEY: expressing logs algebraically

202 ANS: 3
\[ \log 4m^2 = \log 4 + \log m^2 = \log 4 + 2 \log m \]

KEY: splitting logs

203 ANS: 4
\[ \log 2x^3 = \log 2 + \log x^3 = \log 2 + 3 \log x \]

PTS: 2 REF: 061426a2 STA: A2.A.19 TOP: Properties of Logarithms
KEY: splitting logs

204 ANS: 1
\[ \log x = \log a^2 + \log b \]
\[ \log x = \log a^2 b \]
\[ x = a^2 b \]

PTS: 2 REF: 061517a2 STA: A2.A.19 TOP: Properties of Logarithms
KEY: antilogarithms

205 ANS: 1
\[ \log T = \log \frac{10x^2}{y} = \log 10 + \log x^2 - \log y = 1 + 2 \log x - \log y \]

PTS: 2 REF: 011615a2 STA: A2.A.19 TOP: Properties of Logarithms
KEY: splitting logs
206 ANS: 4
\[ 2 \log_4 (5x) = 3 \]
\[ \log_4 (5x) = \frac{3}{2} \]
\[ 5x = 4^{\frac{3}{2}} \]
\[ 5x = 8 \]
\[ x = \frac{8}{5} \]

PTS: 2 REF: fall0921a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced

207 ANS:
\[ x = -\frac{1}{3}, -1 \quad \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \]
\[ \frac{x^3 + x - 2}{x} = (x + 3)^2 \]
\[ \frac{x^3 + x - 2}{x} = x^2 + 6x + 9 \]
\[ x^3 + x - 2 = x^3 + 6x^2 + 9x \]
\[ 0 = 6x^2 + 8x + 2 \]
\[ 0 = 3x^2 + 4x + 1 \]
\[ 0 = (3x + 1)(x + 1) \]
\[ x = -\frac{1}{3}, -1 \]

KEY: basic

208 ANS:
\[ \ln(T - T_o) = -kt + 4.718 \quad \ln(T - 68) = -0.104(10) + 4.718. \]
\[ \ln(150 - 68) = -k(3) + 4.718 \quad \ln(T - 68) = 3.678 \]
\[ 4.407 \approx -3k + 4.718 \quad T - 68 \approx 39.6 \]
\[ k \approx 0.104 \quad T \approx 108 \]

KEY: advanced
209 ANS: 3
\[ x = 5^4 = 625 \]

PTS: 2 REF: 061106a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: basic

210 ANS:
\[ 800. \ x = 4^{2.5} = 32. \ y^{\frac{3}{2}} = 125 \quad \frac{x}{y} = \frac{32}{125} = 800 \]
\[ y = 125^{\frac{2}{3}} = \frac{1}{25} \]

PTS: 4 REF: 011237a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced

211 ANS:
\[ (x + 4)^2 = 17x - 4 \]
\[ x^2 + 8x + 16 = 17x - 4 \]
\[ x^2 - 9x + 20 = 0 \]
\[ (x - 4)(x - 5) = 0 \]
\[ x = 4, 5 \]

PTS: 4 REF: 011336a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: basic

212 ANS:
\[ 2x - 1 = 27^{\frac{4}{3}} \]
\[ 2x - 1 = 81 \]
\[ 2x = 82 \]
\[ x = 41 \]

PTS: 2 REF: 061329a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced
213 ANS:
\[
\log_{(x + 3)}(2x + 3)(x + 5) = 2
\]
\[
-6 \text{ is extraneous}
\]
\[
(x + 3)^2 = (2x + 3)(x + 5)
\]
\[
x^2 + 6x + 9 = 2x^2 + 13x + 15
\]
\[
x^2 + 7x + 6 = 0
\]
\[
(x + 6)(x + 1) = 0
\]
\[
x = -1
\]


214 ANS:
\[
\frac{1}{3} = 4
\]
\[
5x - 1 = 64
\]
\[
5x = 65
\]
\[
x = 13
\]

PTS: 2 REF: 061433a2 STA: A2.A.28 TOP: Logarithmic Equations KEY: advanced

215 ANS: 3 PTS: 2 REF: 011503a2 STA: A2.A.28 TOP: Logarithmic Equations KEY: basic

216 ANS:
\[
(x + 1)^3 = 64
\]
\[
x + 1 = 4
\]
\[
x = 3
\]

PTS: 2 REF: 061531a2 STA: A2.A.28 TOP: Logarithmic Equations KEY: basic

217 ANS:
\[
\log_2 \left( \frac{x^2 - 7x + 12}{2x - 10} \right) = 3
\]
\[
x = \frac{23 \pm \sqrt{(-23)^2 - 4(1)(92)}}{2(1)} \approx 17.84, 5.16
\]
\[
\frac{x^2 - 7x + 12}{2x - 10} = 8
\]
\[
x^2 - 7x + 12 = 16x - 80
\]
\[
x^2 - 23x + 92 = 0
\]

218 ANS:
\[ 8^{x+1} = 16 \]
\[ 2^{3(x+1)} = 2^4 \]
\[ 3x + 3 = 4 \]
\[ 3x = 1 \]
\[ x = \frac{1}{3} \]

PTS: 2  REF: 011630a2  STA: A2.A.28  TOP: Logarithmic Equations
KEY: basic

219 ANS: 3
\[ 75000 = 25000e^{0.0475t} \]
\[ 3 = e^{0.0475t} \]
\[ \ln 3 = \ln e^{0.0475t} \]
\[ \ln 3 = 0.0475t \cdot \ln e \]
\[ \frac{\ln 3}{0.0475} = t \approx 23.1 \]

PTS: 2  REF: 061117a2  STA: A2.A.6  TOP: Exponential Growth

220 ANS: 2
\[ 320 = 10(2)^{\frac{r}{60}} \]
\[ 32 = (2)^{\frac{r}{60}} \]
\[ \log 32 = \log(2)^{\frac{r}{60}} \]
\[ \log 32 = \frac{t \log 2}{60} \]
\[ \frac{60 \log 32}{\log 2} = t \approx 300 = t \]

PTS: 2  REF: 011205a2  STA: A2.A.6  TOP: Exponential Growth
221 ANS:

\[30700 = 50e^{3t}\]

\[614 = e^{3t}\]

\[\ln 614 = \ln e^{3t}\]

\[\ln 614 = 3t \ln e\]

\[\ln 614 = 3t\]

\[2.14 \approx t\]

PTS: 2 REF: 011333a2 STA: A2.A.6 TOP: Exponential Growth

222 ANS: 3

\[1000 = 500e^{0.05t}\]

\[2 = e^{0.05t}\]

\[\ln 2 = \ln e^{0.05t}\]

\[\frac{\ln 2}{0.05} = \frac{0.05 \cdot \ln e}{0.05}\]

\[13.9 \approx t\]

PTS: 2 REF: 061313a2 STA: A2.A.6 TOP: Exponential Growth

223 ANS: 3

\[4x^2 + 4x = 2^{-6}\]

\[2x^2 + 8x = -6\]

\[(2^2)^{x^2 + 4x} = 2^{-6}\]

\[2x^2 + 8x = 2^{-6}\]

\[x^2 + 4x + 3 = 0\]

\[(x + 3)(x + 1) = 0\]

\[x = -3\] \[x = -1\]

PTS: 2 REF: 061015a2 STA: A2.A.27 TOP: Exponential Equations

KEY: common base shown
224 ANS: 4
\[ 9^{3x+1} = 27^{x+2} \]
\( (3^2)^{3x+1} = (3^3)^{x+2} \)
\[ 3^{6x+2} = 3^{3x+6} \]
\[ 6x + 2 = 3x + 6 \]
\[ 3x = 4 \]
\[ x = \frac{4}{3} \]

PTS: 2 REF: 081008a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown

225 ANS:
\[ 16^{2x+3} = 64^{x+2} \]
\( (4^2)^{2x+3} = (4^3)^{x+2} \)
\[ 4x + 6 = 3x + 6 \]
\[ x = 0 \]

PTS: 2 REF: 011128a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown

226 ANS: 2
\[ 4^{2x+5} = 8^{3x} \]
\( \left(2^2\right)^{2x+5} = \left(2^3\right)^{3x} \)
\[ 2^{4x+10} = 2^{9x} \]
\[ 4x + 10 = 9x \]
\[ 10 = 5x \]
\[ 2 = x \]

PTS: 2 REF: 061105a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown
227 ANS:

\[ 81^{ \frac{x}{3} + \frac{2x}{3} } = 27^{ \frac{5x}{3} } \]

\[ \left( 3^4 \right)^{ \frac{x}{3} + \frac{2x}{3} } = \left( 3^3 \right)^{ \frac{5x}{3} } \]

\[ 3^{4x^3 + 8x^2} = 3^{5x} \]

\[ 4x^3 + 8x^2 - 5x = 0 \]

\[ x(4x^2 + 8x - 5) = 0 \]

\[ x(2x - 1)(2x + 5) = 0 \]

\[ x = 0, \frac{1}{2}, -\frac{5}{2} \]

PTS: 6    REF: 061239a2     STA: A2.A.27    TOP: Exponential Equations

KEY: common base not shown

228 ANS: 4

\[ 8^{3k+4} = 4^{2k-1} \]

\[ (2^3)^{3k+4} = (2^2)^{2k-1} \]

\[ 2^{9k+12} = 2^{4k-2} \]

\[ 9k + 12 = 4k - 2 \]

\[ 5k = -14 \]

\[ k = -\frac{14}{5} \]

PTS: 2    REF: 011309a2     STA: A2.A.27    TOP: Exponential Equations

KEY: common base not shown

229 ANS:

\[ \ln e^{4x} = \ln 12 \]

\[ 4x = \ln 12 \]

\[ x = \frac{\ln 12}{4} \]

\[ \approx 0.62 \]

PTS: 2    REF: 011530a2     STA: A2.A.27    TOP: Exponential Equations

KEY: without common base
230 ANS:
\[5^4x = \left(5^\frac{1}{3}\right)^{x-1}\]
\[4x = 3x - 3\]
\[x = -3\]

PTS: 2  REF: 061528a2  STA: A2.A.27  TOP: Exponential Equations

KEY: common base shown

231 ANS:
\[2^{-4} = 2^{3x-1}\]
\[-4 = 3x - 1\]
\[-3 = 3x\]
\[-1 = x\]

PTS: 2  REF: 081529a2  STA: A2.A.27  TOP: Exponential Equations

KEY: common base shown

232 ANS: 1
\[\binom{5}{3}(3x)^2(-2)^3 = 10 \cdot 9x^2 \cdot -8 = -720x^2\]

PTS: 4  REF: fall0919a2  STA: A2.A.36  TOP: Binomial Expansions

233 ANS:
\[32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1.  \quad \binom{5}{0}(2x)^5(-1)^0 = 32x^5.  \quad \binom{5}{1}(2x)^4(-1)^1 = -80x^4.  \quad \binom{5}{2}(2x)^3(-1)^2 = 80x^3.  \quad \binom{5}{3}(2x)^2(-1)^3 = -40x^2.  \quad \binom{5}{4}(2x)^1(-1)^4 = 10x.  \quad \binom{5}{5}(2x)^0(-1)^5 = -1\]

PTS: 2  REF: 011136a2  STA: A2.A.36  TOP: Binomial Expansions

234 ANS: 1
\[\binom{9}{3}a^6(-4b)^3 = -5376a^6b^3\]

PTS: 2  REF: 061126a2  STA: A2.A.36  TOP: Binomial Expansions

235 ANS: 3
\[\binom{3}{2}(2x^4)^1(-y)^2 = 6x^4y^2\]

PTS: 2  REF: 011215a2  STA: A2.A.36  TOP: Binomial Expansions

236 ANS: 3
\[\binom{6}{3}\left(\frac{x}{2}\right)^3(-2y)^3 = 20 \cdot \frac{x^3}{8} \cdot -8y^3 = -20x^3y^3\]

PTS: 2  REF: 061215a2  STA: A2.A.36  TOP: Binomial Expansions

237 ANS: 3
\[\binom{8}{3} \cdot x^{8-3} \cdot (-2)^3 = 56x^5 \cdot (-8) = -448x^5\]

PTS: 2  REF: 011308a2  STA: A2.A.36  TOP: Binomial Expansions
\[ C_2(2x)^5 - 2(-3)^2 = 720x^3 \]

PTS: 2  REF: 011519a2  STA: A2.A.36  TOP: Binomial Expansions

239 ANS: 3  PTS: 2  REF: 081525a2  STA: A2.A.36

TOP: Binomial Expansions

\[ \pm \frac{3}{2}, -\frac{1}{2}, 8x^3 + 4x^2 - 18x - 9 = 0 \]
\[ 4x^2(2x + 1) - 9(2x + 1) = 0 \]
\[ (4x^2 - 9)(2x + 1) = 0 \]
\[ 4x^2 - 9 = 0 \text{ or } 2x + 1 = 0 \]
\[ (2x + 3)(2x - 3) = 0 \quad x = -\frac{1}{2} \]
\[ x = \pm \frac{3}{2} \]

PTS: 4  REF: fall0937a2  STA: A2.A.26  TOP: Solving Polynomial Equations

241 ANS: 2

\[ x^3 + x^2 - 2x = 0 \]
\[ x(x^2 + x - 2) = 0 \]
\[ x(x + 2)(x - 1) = 0 \]
\[ x = 0, -2, 1 \]

PTS: 2  REF: 011103a2  STA: A2.A.26  TOP: Solving Polynomial Equations

242 ANS: 3

\[ 3x^3 - 48x = 0 \]
\[ 3x(x^3 - 16) = 0 \]
\[ 3x(x^2 + 4)(x^2 - 4) = 0 \]
\[ 3x(x^2 + 4)(x + 2)(x - 2) = 0 \]

PTS: 2  REF: 011216a2  STA: A2.A.26  TOP: Solving Polynomial Equations
243 ANS:
\[x^4 + 4x^3 + 4x^2 + 16x = 0\]
\[x(x^3 + 4x^2 + 4x + 16) = 0\]
\[x(x^2(x + 4) + 4(x + 4)) = 0\]
\[x(x^2 + 4)(x + 4) = 0\]
\[x = 0, \pm 2i, -4\]


244 ANS:
\[x^3 + 5x^2 - 4x - 20 = 0\]
\[x^2(x + 5) - 4(x + 5) = 0\]
\[(x^2 - 4)(x + 5) = 0\]
\[(x + 2)(x - 2)(x + 5) = 0\]
\[x = \pm 2, -5\]

PTS: 4  REF: 061437a2  STA: A2.A.26  TOP: Solving Polynomial Equations

245 ANS:
\[x^2(2x - 1) - 4(2x - 1) = 0\]
\[(x^2 - 4)(2x - 1) = 0\]
\[(x + 2)(x - 2)(2x - 1) = 0\]
\[x = \pm 2, \frac{1}{2}\]

PTS: 4  REF: 081537a2  STA: A2.A.26  TOP: Solving Polynomial Equations

246 ANS: 4
PTS: 2
REF: 061005a2  STA: A2.A.50
TOP: Zeros of Polynomials

247 ANS: 2
The roots are \(-1, 2, 3\).

PTS: 2  REF: 081023a2  STA: A2.A.50  TOP: Zeros of Polynomials

248 ANS: 4

PTS: 2  REF: 061222a2  STA: A2.A.50  TOP: Solving Polynomial Equations

249 ANS: 1
PTS: 2
REF: 081501a2  STA: A2.A.50
TOP: Zeros of Polynomials
250 ANS: 4
\((3 + \sqrt{5})(3 - \sqrt{5}) = 9 - \sqrt{25} = 4\)

PTS: 2 REF: 081001a2 STA: A2.N.4 TOP: Operations with Irrational Expressions
KEY: without variables | index = 2

251 ANS:
\[-\frac{a^2 b^3}{4}\]

PTS: 2 REF: 011231a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2

252 ANS: 3
\[3\sqrt[3]{4^2 a^{15}} a = 4a^{\frac{3}{2}} \sqrt[3]{a}\]

PTS: 2 REF: 061204a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2

253 ANS:
\[5\sqrt[3]{3x^3} - 2\sqrt[3]{27x^3} = 5\sqrt{3x^2} 2\sqrt{3x} - 2\sqrt{9x^2} \sqrt{3x} = 5x\sqrt{3x} - 6x\sqrt{3x} = -x\sqrt{3x}\]

PTS: 2 REF: 061032a2 STA: A2.N.2 TOP: Operations with Radicals

254 ANS: 3
\[3\sqrt[3]{6a^4 b^2} + \frac{1}{3}(27 \cdot 6)a^4 b^2
\]
\[a^3 \sqrt[3]{6ab^2} + 3a^3 \sqrt[3]{6ab^2}
\]
\[4a^3 \sqrt[3]{6ab^2}\]

PTS: 2 REF: 011319a2 STA: A2.N.2 TOP: Operations with Radicals

255 ANS: 4
\[\left(\sqrt[3]{27x^2}\right) \left(\sqrt[3]{16x^4}\right) = \sqrt[3]{3^3 \cdot 2^4 \cdot x^6} = 3 \cdot 2 \cdot x^2 \sqrt[3]{2} = 6x^2 \sqrt[3]{2}\]

PTS: 2 REF: 011421a2 STA: A2.N.2 TOP: Operations with Radicals

256 ANS: 1
\[3\sqrt[3]{64a^5 b^6} = 3\sqrt[3]{4^3 a^3 a^2 b^6} = 4ab^2 \sqrt[3]{a^2}\]

PTS: 2 REF: 011516a2 STA: A2.N.2 TOP: Operations with Radicals

257 ANS: 4
\[4ab\sqrt[3]{2b} - 3a\sqrt[3]{9b^2} \sqrt[3]{2b} + 7ab \sqrt[3]{6b} = 4ab \sqrt[3]{2b} - 9ab \sqrt[3]{2b} + 7ab \sqrt[3]{6b} = -5ab \sqrt[3]{2b} + 7ab \sqrt[3]{6b}\]

PTS: 2 REF: fall0918a2 STA: A2.A.14 TOP: Operations with Radicals
KEY: with variables | index = 2
\[
\frac{\sqrt{108x^5y^8}}{\sqrt{6xy^5}} = \sqrt{18x^4y^3} = 3x^2y\sqrt{2y}
\]

PTS: 2  
REF: 011133a2  
STA: A2.A.14  
TOP: Operations with Radicals  
KEY: with variables | index = 2

259 ANS: 3  
PTS: 2  
REF: 061407a2  
STA: A2.A.14  
TOP: Operations with Radicals  
KEY: with variables | index = 2

\[
\sqrt[3]{27a^3} \cdot \sqrt[4]{16b^8} = 3a \cdot 2b^2 = 6ab^2
\]

PTS: 2  
REF: 061504a2  
STA: A2.A.14  
TOP: Operations with Radicals  
KEY: with variables | index > 2

261 ANS: 1  
\[
c = \sqrt{x + \sqrt{2}} + \sqrt{x - \sqrt{2}} = \sqrt{x^2 + 2\sqrt{2}x + 2 + x^2 - 2\sqrt{2}x + 2} = \sqrt{2x^2 + 4}
\]

PTS: 2  
REF: 011626a2  
STA: A2.A.14  
TOP: Operations with Radicals  
KEY: with variables | index = 2

262 ANS: 1  
\[
\frac{5(3 + \sqrt{2})}{7} \cdot \frac{3 + \sqrt{2}}{3 - \sqrt{2}} = \frac{5(3 + \sqrt{2})}{9 - 2} = \frac{5(3 + \sqrt{2})}{7}
\]

PTS: 2  
REF: fall0928a2  
STA: A2.N.5  
TOP: Rationalizing Denominators

263 ANS: 1  
\[
\frac{\sqrt{3} + 5}{\sqrt{3} - 5} \cdot \frac{\sqrt{3} + 5}{\sqrt{3} + 5} = \frac{3 + 5\sqrt{3} + 5\sqrt{3} + 25}{3 - 25} = \frac{28 + 10\sqrt{3}}{-22} = \frac{14 + 5\sqrt{3}}{11}
\]

PTS: 2  
REF: 061012a2  
STA: A2.N.5  
TOP: Rationalizing Denominators

264 ANS: 3  
\[
\frac{4}{5 - \sqrt{13}} \cdot \frac{5 + \sqrt{13}}{5 + \sqrt{13}} = \frac{4(5 + \sqrt{13})}{25 - 13} = \frac{5 + \sqrt{13}}{3}
\]

PTS: 2  
REF: 061116a2  
STA: A2.N.5  
TOP: Rationalizing Denominators

265 ANS: 1  
\[
\frac{7 + \sqrt{11}}{7 - \sqrt{11}} \cdot \frac{7 + \sqrt{11}}{7 + \sqrt{11}} = \frac{7 + \sqrt{11}}{49 - 11} = \frac{7 + \sqrt{11}}{38}
\]

PTS: 2  
REF: 011404a2  
STA: A2.N.5  
TOP: Rationalizing Denominators
266 \text{ ANS: 1 } \frac{5}{4\sqrt{11}} = \frac{4 + \sqrt{11}}{4 + \sqrt{11}} = \frac{5(4 + \sqrt{11})}{16 - 11} = \frac{5(4 + \sqrt{11})}{5} = 4 + \sqrt{11} \\
PTS: 2 \quad \text{REF: 061509a2} \quad \text{STA: A2.N.5} \quad \text{TOP: Rationalizing Denominators}

267 \text{ ANS: 4 } \frac{3 - \sqrt{8}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{3} - \sqrt{24}}{3} = \frac{3\sqrt{3} - 2\sqrt{6}}{3} = \sqrt{3} - \frac{2}{3}\sqrt{6} \\
PTS: 2 \quad \text{REF: 081518a2} \quad \text{STA: A2.N.5} \quad \text{TOP: Rationalizing Denominators}

268 \text{ ANS: 3 } \frac{3}{\sqrt{3a^2b}} = \frac{3}{a\sqrt{3b}} = \frac{\sqrt{3b}}{3ab} \quad \frac{\sqrt{3b}}{ab} \\
PTS: 2 \quad \text{REF: 081019a2} \quad \text{STA: A2.A.15} \quad \text{TOP: Rationalizing Denominators} \quad \text{KEY: index = 2}

269 \text{ ANS: 4 } \frac{2x + 4}{\sqrt{x + 2}} \cdot \frac{\sqrt{x + 2}}{\sqrt{x + 2}} = \frac{2(x + 2)\sqrt{x + 2}}{x + 2} = 2\sqrt{x + 2} \\
PTS: 2 \quad \text{REF: 011122a2} \quad \text{STA: A2.A.15} \quad \text{TOP: Rationalizing Denominators} \quad \text{KEY: index = 2}

270 \text{ ANS: 4 } \frac{x}{x - \sqrt{x}} \cdot \frac{x + \sqrt{x}}{x + \sqrt{x}} = \frac{x^2 + x\sqrt{x}}{x^2 - x} = \frac{x(x + \sqrt{x})}{x(x - 1)} = \frac{x + \sqrt{x}}{x - 1} \\
PTS: 2 \quad \text{REF: 061325a2} \quad \text{STA: A2.A.15} \quad \text{TOP: Rationalizing Denominators} \quad \text{KEY: index = 2}

271 \text{ ANS: 1 } \text{ PTS: 2 } \text{ REF: 061018a2} \quad \text{STA: A2.A.22} \quad \text{TOP: Solving Radicals} \quad \text{KEY: extraneous solutions}

272 \text{ ANS: 3 } 3x + 16 = (x + 2)^2 \quad -4 \text{ is an extraneous solution.} \\
3x + 16 = x^2 + 4x + 4 \\
0 = x^2 + x - 12 \\
0 = (x + 4)(x - 3) \\
x = -4 \quad x = 3 \\
PTS: 2 \quad \text{REF: 061121a2} \quad \text{STA: A2.A.22} \quad \text{TOP: Solving Radicals} \quad \text{KEY: extraneous solutions}
7. \(4 - \sqrt{2x - 5} = 1\)
\[-\sqrt{2x - 5} = -3\]
\[2x - 5 = 9\]
\[2x = 14\]
\[x = 7\]

ANS: \(4 - \sqrt{2x - 5} = 1\)
\[-\sqrt{2x - 5} = -3\]
\[2x - 5 = 9\]
\[2x = 14\]
\[x = 7\]

PTS: 2       REF: 011229a2       STA: A2.A.22       TOP: Solving Radicals
KEY: basic

5x + 29 = (x + 3)^2  .  (-5) + 3 shows an extraneous solution.

\[5x + 29 = x^2 + 6x + 9\]
\[0 = x^2 + x - 20\]
\[0 = (x + 5)(x - 4)\]
\[x = -5, 4\]

ANS: \(5x + 29 = (x + 3)^2\)  .  (-5) + 3 shows an extraneous solution.
\[5x + 29 = x^2 + 6x + 9\]
\[0 = x^2 + x - 20\]
\[0 = (x + 5)(x - 4)\]
\[x = -5, 4\]

PTS: 2       REF: 061213a2       STA: A2.A.22       TOP: Solving Radicals
KEY: extraneous solutions

\(\sqrt{x^2 + x - 1} = -4x + 3\) \(-4 \left( \frac{2}{3} \right) + 3 \geq 0\)
\[x^2 + x - 1 = 16x^2 - 24x + 9\]
\[0 = 15x^2 - 25x + 10\]
\[0 = 3x^2 - 5x + 2\]
\[0 = (3x - 2)(x - 1)\]  \[1\) is extraneous
\[x = \frac{2}{3}, x \neq 1\]

ANS: \(\sqrt{x^2 + x - 1} = -4x + 3\) \(-4 \left( \frac{2}{3} \right) + 3 \geq 0\)
\[x^2 + x - 1 = 16x^2 - 24x + 9\]
\[0 = 15x^2 - 25x + 10\]
\[0 = 3x^2 - 5x + 2\]
\[0 = (3x - 2)(x - 1)\]  \[1\) is extraneous
\[x = \frac{2}{3}, x \neq 1\]

PTS: 6       REF: 011339a2       STA: A2.A.22       TOP: Solving Radicals
KEY: extraneous solutions
276 ANS: 2
\[ \sqrt{2x - 4} = x - 2 \]
\[ 2x - 4 = x^2 - 4x + 4 \]
\[ 0 = x^2 - 6x + 8 \]
\[ 0 = (x - 4)(x - 2) \]
\[ x = 4, 2 \]

PTS: 2 REF: 061406a2 STA: A2.A.22 TOP: Solving Radicals
KEY: extraneous solutions

277 ANS:
\[ \sqrt{2x + 1} = 4 \]
\[ 2x + 1 = 16 \]
\[ 2x = 15 \]
\[ x = \frac{15}{2} \]

PTS: 2 REF: 011628a2 STA: A2.A.22 TOP: Solving Radicals
KEY: basic

278 ANS: 2 PTS: 2 REF: 061011a2 STA: A2.A.10 TOP: Fractional Exponents as Radicals

279 ANS: 4
\[ x^{-\frac{2}{5}} = \frac{1}{x^\frac{2}{5}} = \frac{1}{\sqrt[5]{x^2}} \]

PTS: 2 REF: 011118a2 STA: A2.A.10 TOP: Fractional Exponents as Radicals

280 ANS: 1
\[ 4\sqrt[4]{16x^2y^7} = 16^{\frac{1}{4}}x^{\frac{2}{4}}y^{\frac{7}{4}} = 2x^{\frac{1}{2}}y^{\frac{7}{4}} \]

PTS: 2 REF: 061107a2 STA: A2.A.11 TOP: Radicals as Fractional Exponents

281 ANS: 1
\[ 4\sqrt[4]{81x^2y^5} = 81^{\frac{1}{4}}x^{\frac{2}{4}}y^{\frac{5}{4}} = 3x^{\frac{1}{2}}y^{\frac{5}{4}} \]

PTS: 2 REF: 081504a2 STA: A2.A.11 TOP: Radicals as Fractional Exponents

282 ANS: 1
\[ 3\sqrt[3]{27a^{-6}b^3c^{-2}} = 3a^{-2}bc^{-\frac{2}{3}} = \frac{3bc^2}{a^2} \]

PTS: 2 REF: 011606a2 STA: A2.A.11 TOP: Radicals as Fractional Exponents
283 ANS: 3
\[ \sqrt{-300} = \sqrt{100} \sqrt{-1} \sqrt{3} \]

PTS: 2 REF: 061006a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

284 ANS: 3
\[ \sqrt{9} \sqrt{-1} \sqrt{2} - \sqrt{16} \sqrt{-1} \sqrt{2} = 3i \sqrt{2} - 4i \sqrt{2} = -i \sqrt{2} \]

PTS: 2 REF: 061404a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

285 ANS: 4
\[ \sqrt{-180}x^{16} = 6x^8i \sqrt{5} \]

PTS: 2 REF: 081524a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

286 ANS: 1 PTS: 2 REF: 061019a2 STA: A2.N.7 TOP: Imaginary Numbers

287 ANS: 1
\[ 2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i \]

PTS: 2 REF: 081004a2 STA: A2.N.7 TOP: Imaginary Numbers

288 ANS:
\[ i^{13} + i^{18} + i^{31} + n = 0 \]
\[ i + (-1) - i + n = 0 \]
\[ -1 + n = 0 \]
\[ n = 1 \]

PTS: 2 REF: 061228a2 STA: A2.N.7 TOP: Imaginary Numbers

289 ANS:
\[ 4xi + 5yi^8 + 6xi^3 + 2yi^4 = 4xi + 5y - 6xi + 2y = 7y - 2xi \]

PTS: 2 REF: 011433a2 STA: A2.N.7 TOP: Imaginary Numbers

290 ANS:
\[ xi^8 - yi^6 = x(1) - y(-1) = x + y \]

PTS: 2 REF: 061533a2 STA: A2.N.7 TOP: Imaginary Numbers

291 ANS: 3
\[ x(27i^6) + x(2i^{12}) = -27x + 2x = -25x \]

PTS: 2 REF: 011620a2 STA: A2.N.7 TOP: Imaginary Numbers

292 ANS: 2 PTS: 2 REF: 081024a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers

293 ANS: 4 PTS: 2 REF: 011111a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers

294 ANS: 2 PTS: 2 REF: 011213a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers
295 ANS: 3  PTS: 2  REF: 061219a2  STA: A2.N.8
TOP: Conjugates of Complex Numbers

296 ANS: 2

$(3 - 7i)(3 - 7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i$

PTS: 2  REF: fall0901a2  STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

297 ANS: 4

$(x + i)^2 - (x - i)^2 = x^2 + 2xi + i^2 - (x^2 - 2xi + i^2) = 4xi$

PTS: 2  REF: 011327a2  STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

298 ANS: 3

$(3i)(2i)^2(m + i)$

$(3i)(4i^2)(m + i)$

$(3i)(-4)(m + i)$

$(-12i)(m + i)$

$-12mi - 12i^2$

$-12mi + 12$

PTS: 2  REF: 061319a2  STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

299 ANS:

$(x + yi)(x - yi) = x^2 - y^2i^2 = x^2 + y^2$

PTS: 2  REF: 061432a2  STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

300 ANS: 4

$(-3 - 2i)(-3 + 2i) = 9 - 4i^2 = 9 + 4 = 13$

PTS: 2  REF: 011512a2  STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

301 ANS:

$2xi(i - 4i^3) = 2xi^2 - 8xi^3 = 2xi^2 - 8xi^3 = -2x + 8xi$

PTS: 2  REF: 011533a2  STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers
\[
\begin{align*}
\text{302 ANS:} & \quad \frac{-2(x^2 + 6)}{x^4} \cdot \frac{x^2(x - 3) + 6(x - 3)}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2} \\
& \quad \left(\frac{x^2 + 6)(x - 3)}{x(x - 4)} \cdot \frac{2(x - 2)}{x^3(x - 3)} \cdot \frac{(4 + x)(4 - x)}{(x + 4)(x - 2)} \right) \\
& \quad \frac{-2(x^2 + 6)}{x^4}
\end{align*}
\]

PTS: 6  REF: 011239a2  STA: A2.A.16  TOP: Multiplication and Division of Rationals

KEY: division

\[
\begin{align*}
\text{303 ANS:} & \quad 4 \\
& \quad \frac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x) = \frac{(x + 11)(x - 2)}{(x + 11)(x - 11)} \cdot \frac{-1}{x - 2} = \frac{-1}{x - 11}
\end{align*}
\]

PTS: 2  REF: 011423a2  STA: A2.A.16  TOP: Multiplication and Division of Rationals

KEY: division

\[
\begin{align*}
\text{304 ANS:} & \quad 3 \\
& \quad \frac{3y}{2y - 6} + \frac{9}{6 - 2y} = \frac{3y}{2y - 6} - \frac{9}{2y - 6} = \frac{3y - 9}{2y - 6} = \frac{3(y - 3)}{2(y - 3)} = \frac{3}{2}
\end{align*}
\]


\[
\begin{align*}
\text{305 ANS:} & \quad 3 \\
& \quad \frac{x}{x - 1} + \frac{1}{2x - 2} = \frac{2x}{2(x - 1)} + \frac{1}{2(x - 1)} = \frac{2x + 1}{2(x - 1)}
\end{align*}
\]

PTS: 2  REF: 011608a2  STA: A2.A.16  TOP: Addition and Subtraction of Rationals

\[
\begin{align*}
\text{306 ANS:} & \quad \text{no solution.} \\
& \quad \frac{4x}{x - 3} = 2 + \frac{12}{x - 3} \\
& \quad \frac{4x - 12}{x - 3} = 2 \\
& \quad \frac{4(x - 3)}{x - 3} = 2 \\
& \quad 4 \neq 2
\end{align*}
\]

PTS: 2  REF: fall0930a2  STA: A2.A.23  TOP: Solving Rationals

KEY: rational solutions
307 ANS: 
\[
\frac{1}{3} \frac{1}{x + 3} - \frac{2}{3 - x} = \frac{4}{x^2 - 9} \\
\frac{1}{x + 3} + \frac{2}{x - 3} = \frac{4}{x^2 - 9} \\
x - 3 + 2(x + 3) = 4 \quad \frac{4}{(x + 3)(x - 3)} \quad (x + 3)(x - 3) = 4 \\
x - 3 + 2x + 6 = 4 \\
3x = 1 \\
x = \frac{1}{3}
\]

PTS: 4  REF: 081036a2  STA: A2.A.23  TOP: Solving Rationals  
KEY: rational solutions

308 ANS: 
\[
\frac{13}{x} = 10 - x \\
\cdot \quad x = \frac{10 \pm \sqrt{100 - 4(1)(13)}}{2(1)} = \frac{10 \pm \sqrt{48}}{2} = \frac{10 \pm 4\sqrt{3}}{2} = 5 \pm 2\sqrt{3} \\
\]
\[
13 = 10x - x^2 \\
x^2 - 10x + 13 = 0
\]

PTS: 4  REF: 061336a2  STA: A2.A.23  TOP: Solving Rationals  
KEY: irrational and complex solutions

309 ANS: 2
\[
\frac{30}{(x + 3)(x - 3)} + \frac{(x + 3)(x - 3)}{(x + 3)(x - 3)} = \frac{5(x + 3)}{(x - 3)(x + 3)} \\
\]
3 is an extraneous root.
\[
30 + x^2 - 9 = 5x + 15 \\
x^2 - 5x + 6 = 0 \\
(x - 3)(x - 2) = 0 \\
x = 2
\]

PTS: 2  REF: 061417a2  STA: A2.A.23  TOP: Solving Rationals  
KEY: rational solutions
\[ \frac{5x}{x(x-3)} - \frac{2(x-3)}{x(x-3)} = \frac{x(x-3)}{x(x-3)} \]

\[ 5x - 2x + 6 = x^2 - 3x \]

\[ 0 = x^2 - 6x - 6 \]

PTS: 2  REF: 011522a2  STA: A2.A.23  TOP: Solving Rationals

KEY: irrational and complex solutions

\[ \frac{3}{x} + \frac{x}{x+2} = \frac{2}{x+2} \]

\[ \frac{x+2}{x+2} = \frac{3}{x} \]

\[ 1 = \frac{3}{x} \]

\[ x = -3 \]

PTS: 4  REF: 061537a2  STA: A2.A.23  TOP: Solving Rationals

KEY: rational solutions

\[ \frac{10x}{4} = \frac{1}{x} + \frac{x}{4} \]

\[ \frac{9x}{4} = \frac{1}{x} \]

\[ 9x^2 = 4 \]

\[ x^2 = \frac{4}{9} \]

\[ x = \pm \frac{2}{3} \]

PTS: 2  REF: 081534a2  STA: A2.A.23  TOP: Solving Rationals

KEY: rational solutions
313 ANS: 3
\[
\frac{x + 16}{x - 2} - \frac{7(x - 2)}{x - 2} \leq 0 \quad -6x + 30 = 0 \quad x - 2 = 0. \text{ Check points such that } x < 2, 2 < x < 5, \text{ and } x > 5. \text{ If } x = 1, -6x + 30 \leq 0 \quad -6x = -30 \quad x = 2
\]
\[
\frac{-6(1) + 30}{1 - 2} = \frac{24}{-1} = -24, \text{ which is less than 0. If } x = 3, \quad \frac{-6(3) + 30}{3 - 2} = \frac{12}{1} = 12, \text{ which is greater than 0. If } x = 6, \quad \frac{-6(6) + 30}{6 - 2} = \frac{-6}{4} = \frac{3}{2}, \text{ which is less than 0.}
\]

PTS: 2  REF: 011424a2  STA: A2.A.23  TOP: Rational Inequalities

314 ANS: 2
\[
\frac{x - 1}{x} = \frac{x^2 - 4}{4x} \quad \frac{1}{2x + 4} = \frac{x + 2}{4x} \times \frac{8x}{2(x + 2)} = x - 2
\]

PTS: 2  REF: fall0920a2  STA: A2.A.17  TOP: Complex Fractions

315 ANS:
\[
\frac{1}{d} - \frac{4}{2d} = \frac{d - 8}{2d} \quad \frac{1}{2} + \frac{3}{2d} = \frac{d - 8}{2d + 3d} \quad \frac{1}{d^2} = \frac{d - 8}{2d^2}
\]

PTS: 2  REF: 061035a2  STA: A2.A.17  TOP: Complex Fractions

316 ANS:
\[
\frac{-(x^2 - 4)}{(x + 4)(x + 3)} \times \frac{x + 3}{2(x - 2)} = \frac{-(x + 2)(x - 2)}{x + 4} \times \frac{1}{2(x - 2)} = \frac{-(x + 2)}{2(x + 4)}
\]

PTS: 4  REF: 061236a2  STA: A2.A.17  TOP: Complex Fractions

317 ANS: 2
\[
\frac{1}{x} - \frac{4}{x^2} \times \frac{x^2}{x^2 - 8} = \frac{x^2 - 4x}{x^2 - 2x - 8} = \frac{x(x - 4)}{(x - 4)(x + 2)} = \frac{x}{x + 2}
\]

PTS: 2  REF: 061305a2  STA: A2.A.17  TOP: Complex Fractions

318 ANS: 3
\[
\frac{a + b}{c} = \frac{ac + b}{cd} \quad \frac{d - b}{c} = \frac{cd - b}{c}
\]

PTS: 2  REF: 011405a2  STA: A2.A.17  TOP: Complex Fractions
319 ANS:
\[
\frac{1 + \frac{3}{x}}{\frac{5}{x}} \cdot \frac{x^2}{24} = \frac{x^2 + 3x}{x^2 - 5x - 24} = \frac{x(x + 3)}{(x - 8)(x + 3)} = \frac{x}{x - 8}
\]

PTS: 4    REF: 061436a2    STA: A2.A.17    TOP: Complex Fractions

320 ANS:
\[
\frac{(6 - x)(6 + x)}{x - 3} \cdot \frac{x + 6}{(x + 6)(x + 6)} = 6 - x
\]

PTS: 2    REF: 011529a2    STA: A2.A.17    TOP: Complex Fractions

321 ANS: 4
\[
\frac{3x + y}{xy} \cdot \frac{x^2}{2} = \frac{3x + y}{xy} \cdot \frac{2}{2} = \frac{3x + y}{2}
\]

PTS: 2    REF: 011603a2    STA: A2.A.17    TOP: Complex Fractions

322 ANS:
\[
12 \cdot 6 = 9w
\]
\[
8 = w
\]

PTS: 2    REF: 011130a2    STA: A2.A.5    TOP: Inverse Variation

323 ANS: 1
\[
10 \cdot \frac{3}{2} = \frac{3}{5}p
\]
\[
15 = \frac{3}{5}p
\]
\[
25 = p
\]

PTS: 2    REF: 011226a2    STA: A2.A.5    TOP: Inverse Variation

324 ANS: 1
\[
20(-2) = x(-2x + 2)
\]
\[
-40 = -2x^2 + 2x
\]
\[
2x^2 - 2x - 40 = 0
\]
\[
x^2 - x - 20 = 0
\]
\[
(x + 4)(x - 5) = 0
\]
\[
x = -4, 5
\]

PTS: 2    REF: 011321a2    STA: A2.A.5    TOP: Inverse Variation
325 ANS: 2
\[2^2 \cdot 3 = 12 \cdot 6^2 d = 12\]
\[4^2 \cdot \frac{3}{4} = 12 \quad 36d = 12\]
\[d = \frac{1}{3}\]

PTS: 2  REF: 061310a2  STA: A2.A.5  TOP: Inverse Variation

326 ANS: 3
\[20 \cdot 2 = -5t\]
\[-8 = t\]

PTS: 2  REF: 011412a2  STA: A2.A.5  TOP: Inverse Variation

327 ANS:
\[25 \cdot 6 = 30q\]
\[5 = q\]

PTS: 2  REF: 011528a2  STA: A2.A.5  TOP: Inverse Variation

328 ANS: 2  PTS: 2  REF: 061510a2  STA: A2.A.5  TOP: Inverse Variation

329 ANS: 4
\[3 \cdot 400 = 8x\]
\[150 = x\]

PTS: 2  REF: 081507a2  STA: A2.A.5  TOP: Inverse Variation

330 ANS: 4
\[y - 2 \sin \theta = 3\]
\[y = 2 \sin \theta + 3\]
\[f(\theta) = 2 \sin \theta + 3\]

PTS: 2  REF: fall0927a2  STA: A2.A.40  TOP: Functional Notation

331 ANS: 2
\[f(10) = \frac{-10}{(-10)^2 - 16} = \frac{-10}{84} = -\frac{5}{42}\]

PTS: 2  REF: 061102a2  STA: A2.A.41  TOP: Functional Notation

332 ANS:
\[g(10) = \left[a(10) \sqrt{1 - 10}\right]^2 = 100a^2(-9) = -900a^2\]

PTS: 2  REF: 061333a2  STA: A2.A.41  TOP: Functional Notation
\[ f(a + 1) = 4(a + 1)^2 - (a + 1) + 1 \]
\[ = 4(a^2 + 2a + 1) - a \]
\[ = 4a^2 + 8a + 4 - a \]
\[ = 4a^2 + 7a + 4 \]

ANS: 4

\[ f(x + 3) = 2(x + 3)^2 - 3(x + 3) + 4 = 2x^2 + 12x + 18 - 3x - 9 + 4 = 2x^2 + 9x + 13 \]

ANS: 3

As originally written, alternatives (2) and (3) had no domain restriction, so that both were correct.
(4) fails the horizontal line test. Not every element of the range corresponds to only one element of the domain.

(1) and (4) fail the horizontal line test and are not one-to-one. Not every element of the range corresponds to only one element of the domain. (2) fails the vertical line test and is not a function. Not every element of the domain corresponds to only one element of the range.

\[ D: -5 \leq x \leq 8. \quad R: -3 \leq y \leq 2 \]

370 ANS: 3  
\[ f(4) = \frac{1}{2}(4) - 3 = -1. \quad g(-1) = 2(-1) + 5 = 3 \]  

371 ANS: 2  
\[ 6(x^2 - 5) = 6x^2 - 30 \]

372 ANS: 2  
7. \( f(-3) = (-3)^2 - 6 = 3 \). \( g(x) = 2^3 - 1 = 7 \).

373 ANS: 4  
\[ g\left(\frac{1}{2}\right) = \frac{1}{2} = 2. \quad f(2) = 4(2) - 2^2 = 4 \]

374 ANS: 2  
PTS: 2  REF: 061135a2  STA: A2.A.42  TOP: Compositions of Functions  KEY: variables

375 ANS: 3  
\[ h(-8) = \frac{1}{2}(-8) - 2 = -4 - 2 = -6. \quad g(-6) = \frac{1}{2}(-6) + 8 = -3 + 8 = 5 \]

376 ANS: 1  
\[ f(g(x)) = 2(x + 5)^2 - 3(x + 5) + 1 = 2(x^2 + 10x + 25) - 3x - 15 + 1 = 2x^2 + 17x + 36 \]

377 ANS: 4  
\[ g(-2) = 3(-2) - 2 = -8 \quad f(-8) = 2(-8)^2 + 1 = 128 + 1 = 129 \]

28
378 ANS:
\[(x + 1)^2 - (x + 1) = x^2 + 2x + 1 - x - 1 = x^2 + x\]

PTS: 2  REF: 081530a2  STA: A2.A.42  TOP: Compositions of Functions
KEY: variables

379 ANS: 3  PTS: 2  REF: 081027a2  STA: A2.A.44
TOP: Inverse of Functions  KEY: equations

380 ANS:
\[y = x^2 - 6. \ f^{-1}(x) \text{ is not a function.} \]
\[x = y^2 - 6\]
\[x + 6 = y^2\]
\[\pm \sqrt{x + 6} = y\]

PTS: 2  REF: 061132a2  STA: A2.A.44  TOP: Inverse of Functions
KEY: equations

381 ANS: 2  PTS: 2  REF: 061521a2  STA: A2.A.44
TOP: Inverse of Functions  KEY: equations

382 ANS: 2  PTS: 2  REF: 081523a2  STA: A2.A.44
TOP: Inverse of Functions  KEY: ordered pairs

383 ANS: 2  PTS: 2  REF: fall0926a2  STA: A2.A.46
TOP: Graphing Quadratic Functions

384 ANS: 1  PTS: 2  REF: 081022a2  STA: A2.A.46
TOP: Transformations with Functions

385 ANS:

386 ANS: 1  PTS: 2  REF: 061516a2  STA: A2.A.46
TOP: Transformations with Functions

387 ANS: 4  PTS: 2  REF: 061026a2  STA: A2.A.29
TOP: Sequences
common difference is 2. \( b_n = x + 2n \)

\[
10 = x + 2(1) \\
8 = x
\]

PTS: 2  REF: 081014a2  STA: A2.A.29  TOP: Sequences

\[
\frac{10}{4} = 2.5
\]

PTS: 2  REF: 011217a2  STA: A2.A.29  TOP: Sequences

\[
\frac{31 - 19}{7 - 4} = \frac{12}{3} = 4 \quad x + (4 - 1)4 = 19 \quad a_n = 7 + (n - 1)4
\]

\[
x + 12 = 19
\]

\[
x = 7
\]

PTS: 2  REF: 011434a2  STA: A2.A.29  TOP: Sequences

PTS: 2  REF: 061520a2  STA: A2.A.29  TOP: Sequences
Algebra 2/Trigonometry Regents Exam Questions by Performance Indicator: Topic
Answer Section

392 ANS: 3 PTS: 2 REF: 061001a2 STA: A2.A.30 TOP: Sequences

393 ANS: 3 PTS: 2 REF: 011110a2 STA: A2.A.30 TOP: Sequences

394 ANS: 1
\[(4a + 4) - (2a + 1) = 2a + 3\]

PTS: 2 REF: 011401a2 STA: A2.A.30 TOP: Sequences


396 ANS: 2 PTS: 2 REF: 011610a2 STA: A2.A.30 TOP: Sequences

397 ANS: 3

\[27r^{4 - 1} = 64\]

\[r^3 = \frac{64}{27}\]

\[r = \frac{4}{3}\]

PTS: 2 REF: 081025a2 STA: A2.A.31 TOP: Sequences

398 ANS: 3

\[\frac{4}{-2} = -2\]

PTS: 2 REF: 011304a2 STA: A2.A.31 TOP: Sequences

399 ANS: 2

\[-\frac{3}{32} a^3 b^4 - \frac{1}{64} a^5 b^3 = -\frac{6b}{a^2}\]

PTS: 2 REF: 061326a2 STA: A2.A.31 TOP: Sequences

400 ANS: 1

\[\frac{3}{4} \div \frac{1}{2} = \frac{3}{2}\]

PTS: 2 REF: 011508a2 STA: A2.A.31 TOP: Sequences
401 ANS: 3
\[ a_n = 5(-2)^{n-1} \]
\[ a_{15} = 5(-2)^{15-1} = 81,920 \]

PTS: 2 REF: 011105a2 STA: A2.A.32 TOP: Sequences

402 ANS: 1
\[ a_n = -\sqrt[5]{5(-2)^{n-1}} \]
\[ a_{15} = -\sqrt[5]{5(-2)^{15-1}} = -\sqrt[5]{5(-2)^{14}} = -\sqrt[5]{5 \cdot 2^7} = -128\sqrt[5]{5} \]

PTS: 2 REF: 061109a2 STA: A2.A.32 TOP: Sequences

403 ANS: 3
\[ \frac{40 - 10}{6 - 1} = \frac{30}{5} = 6 \quad a_n = 6n + 4 \]
\[ a_{20} = 6(20) + 4 = 124 \]

PTS: 2 REF: 081510a2 STA: A2.A.32 TOP: Sequences

404 ANS: 
\[-3, -5, -8, -12 \]

PTS: 2 REF: fall0934a2 STA: A2.A.33 TOP: Sequences

405 ANS:
\[ a_1 = 3. \quad a_2 = 2(3) - 1 = 5. \quad a_3 = 2(5) - 1 = 9. \]

PTS: 2 REF: 061233a2 STA: A2.A.33 TOP: Sequences

406 ANS:
\[ a_2 = 3(2)^{-2} = \frac{3}{4} \quad a_3 = 3\left(\frac{3}{4}\right)^{-2} = \frac{16}{3} \quad a_4 = 3\left(\frac{16}{3}\right)^{-2} = \frac{27}{256} \]

PTS: 4 REF: 011537a2 STA: A2.A.33 TOP: Sequences

407 ANS: 3
\[ a_4 = 3xy^5\left(\frac{2x}{y}\right)^3 = 3xy^5\left(\frac{8x^3}{y^3}\right) = 24x^4y^2 \]

PTS: 2 REF: 061512a2 STA: A2.A.33 TOP: Sequences

408 ANS: 1

TOP: Sequences

409 ANS: 1
\[ a_2 = \frac{1}{2}(-6) - 2 = -5 \]
\[ a_3 = \frac{1}{2}(-5) - 3 = -\frac{11}{2} \]

PTS: 2 REF: 011623a2 STA: A2.A.33 TOP: Sequences
### 410 ANS: 3

<table>
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<tr>
<th>n</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n^2 + 2^n)</td>
<td>(0^2 + 2^0 = 1)</td>
<td>(1^2 + 2^1 = 3)</td>
<td>(2^2 + 2^2 = 8)</td>
<td>(12)</td>
</tr>
</tbody>
</table>

\[2 \times 12 = 24\]

PTS: 2  
REF: fall0911a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: basic

### 411 ANS: 230.  
\[10 + (1^3 - 1) + (2^3 - 1) + (3^3 - 1) + (4^3 - 1) + (5^3 - 1) = 10 + 0 + 7 + 26 + 63 + 124 = 230\]

PTS: 2  
REF: 011131a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: basic

### 412 ANS: 1

\(\sum -r^2 + r\)  
\(-3^2 + 3 = -6\)  
\(-4^2 + 4 = -12\)  
\(-5^2 + 5 = -20\)

\(\sum -38\)

PTS: 2  
REF: 061118a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: basic

### 413 ANS:  
\[-\frac{1}{2} \left( \sum_{n=1}^{3} (-x^n-x) \right) \]

\(-104\)

PTS: 2  
REF: 011230a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: basic

### 414 ANS: 4

\[4 + 3(2-x) + 3(3-x) + 3(4-x) + 3(5-x)\]
\[4 + 6 - 3x + 9 - 3x + 12 - 3x + 15 - 3x\]
\[46 - 12x\]

PTS: 2  
REF: 061315a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: advanced

### 415 ANS: 4

\[(a-1)^2 + (a-2)^2 + (a-3)^2 + (a-4)^2\]
\[(a^2 - 2a + 1) + (a^2 - 4a + 4) + (a^2 - 6a + 9) + (a^2 - 8a + 16)\]
\[4a^2 - 20a + 30\]

PTS: 2  
REF: 011414a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: advanced
\[(3 - 2a)^0 + (3 - 2a)^1 + (3 - 2a)^2 = 1 + 3 - 2a + 9 - 12a + 4a^2 = 4a^2 - 14a + 13\]

**ANS:** 4  
**PTS:** 2  
**REF:** 061526a2  
**STA:** A2.N.10  
**TOP:** Sigma Notation  
**KEY:** advanced

\[x - 1 + x - 4 + x - 9 + x - 16 = 4x - 30\]

**ANS:**  
**PTS:** 2  
**REF:** 081535a2  
**STA:** A2.N.10  
**TOP:** Sigma Notation  
**KEY:** advanced

\[\cos \frac{\pi}{2} + \cos \pi + \cos \frac{3\pi}{2} = 0 + -1 + 0 = -1\]

**ANS:** 2  
**PTS:** 2  
**REF:** 011617a2  
**STA:** A2.N.10  
**TOP:** Sigma Notation  
**KEY:** advanced

\[\sum_{n=1}^{15} 7n\]

**ANS:**  
**PTS:** 2  
**REF:** 081029a2  
**STA:** A2.A.34  
**TOP:** Sigma Notation

\[S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{21}{2} [2(18) + (21 - 1)2] = 798\]

**ANS:** 4  
**PTS:** 2  
**REF:** 061103a2  
**STA:** A2.A.35  
**TOP:** Series  
**KEY:** arithmetic

\[S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{19}{2} [2(3) + (19 - 1)7] = 1254\]

**ANS:** 3  
**PTS:** 2  
**REF:** 011202a2  
**STA:** A2.A.35  
**TOP:** Series  
**KEY:** arithmetic
426 ANS:

\[ a_n = 9n - 4 \quad . \quad S_n = \frac{20(5 + 176)}{2} = 1810 \]

\[ a_1 = 9(1) - 4 = 5 \]

\[ a_{20} = 9(20) - 4 = 176 \]

PTS: 2 \quad REF: 011328a2 \quad STA: A2.A.35 \quad TOP: Series

KEY: arithmetic

427 ANS: 3

\[ S_8 = \frac{3(1 - (-4)^8)}{1 - (-4)} = \frac{196.605}{5} = -39.321 \]

PTS: 2 \quad REF: 061304a2 \quad STA: A2.A.35 \quad TOP: Series

KEY: geometric

428 ANS: 1

\[
\cos K = \frac{5}{6} \\
K = \cos^{-1} \frac{5}{6} \\
K \approx 33^\circ 33' 
\]

PTS: 2 \quad REF: 061023a2 \quad STA: A2.A.55 \quad TOP: Trigonometric Ratios

429 ANS: 2

PTS: 2 \quad REF: 081010a2 \quad STA: A2.A.55 

TOP: Trigonometric Ratios

430 ANS: 1

\[ \sqrt{12^2 - 6^2} = \sqrt{108} = \sqrt{36 \times 3} = 6\sqrt{3} \]

\[ \cot J = \frac{A}{O} = \frac{6}{6\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3} \]

PTS: 2 \quad REF: 011120a2 \quad STA: A2.A.55 \quad TOP: Trigonometric Ratios

431 ANS: 2

PTS: 2 \quad REF: 011315a2 \quad STA: A2.A.55 

TOP: Trigonometric Ratios
\[
\sin S = \frac{8}{17}
\]

\[
S = \sin^{-1} \frac{8}{17}
\]

\[
S \approx 28^\circ 4'
\]

433 ANS: 3

\[
2\pi \cdot \frac{5}{12} = \frac{10\pi}{12} = \frac{5\pi}{6}
\]

435 ANS: 2

\[
197^\circ 40'. \ 3.45 \times \frac{180}{\pi} \approx 197^\circ 40'.
\]

437 ANS: 2

\[
\frac{11\pi}{12} \cdot \frac{180}{\pi} = 165
\]

438 ANS: 1

\[
-420 \left( \frac{\pi}{180} \right) = \frac{7\pi}{3}
\]
\[
2.5 \cdot \frac{180}{\pi} \approx 143.2^\circ
\]

**PTS:** 2  
**REF:** 011129a2  
**STA:** A2.M.2  
**TOP:** Radian Measure

**440**  
**ANS:** 1  
\[
2 \cdot \frac{180}{\pi} = \frac{360}{\pi}
\]

**PTS:** 2  
**REF:** 011220a2  
**STA:** A2.M.2  
**TOP:** Radian Measure

**441**  
**ANS:**  
\[
216 \left( \frac{\pi}{180} \right) \approx 3.8
\]

**PTS:** 2  
**REF:** 061232a2  
**STA:** A2.M.2  
**TOP:** Radian Measure

**442**  
**ANS:**  
\[
\left(3 \cdot \frac{180}{\pi}\right) \text{ DMS} \\
171^\circ53'14.419''
\]

\[
3 \times \frac{180}{\pi} \approx 171.89^\circ \approx 171^\circ53'.
\]

**PTS:** 2  
**REF:** 011335a2  
**STA:** A2.M.2  
**TOP:** Radian Measure

**443**  
**ANS:** 2  
\[
\frac{8\pi}{5} \cdot \frac{180}{\pi} = 288
\]

**PTS:** 2  
**REF:** 061302a2  
**STA:** A2.M.2  
**TOP:** Radian Measure

**444**  
**ANS:** 1  
\[
5 \cdot \frac{180}{\pi} \approx 286
\]

**PTS:** 2  
**REF:** 011427a2  
**STA:** A2.M.2  
**TOP:** Radian Measure
ANS: \[ 2.5 \cdot \frac{180}{\pi} \approx 143^\circ 14' \]

PTS: 2  
REF: 061431a2  
STA: A2.M.2  
TOP: Radian Measure

KEY: degrees

ANS: \[ \frac{5}{11} \pi \left( \frac{180}{\pi} \right) = 81^\circ 49' \]

PTS: 2  
REF: 011531a2  
STA: A2.M.2  
TOP: Radian Measure

KEY: degrees

ANS: \[ 2.5 \left( \frac{180}{\pi} \right) = 143^\circ 14' \]

PTS: 2  
REF: 081528a2  
STA: A2.M.2  
TOP: Radian Measure

KEY: degrees

ANS: \[ -130 \cdot \frac{\pi}{180} \approx -2.27 \]

PTS: 2  
REF: 011632a2  
STA: A2.M.2  
TOP: Radian Measure

KEY: radians

ANS:

\[ \frac{\sqrt{3}}{2} \]

PTS: 2  
REF: 061033a2  
STA: A2.A.60  
TOP: Unit Circle

ANS: 4

PTS: 2  
REF: 081005a2  
STA: A2.A.60

TOP: Unit Circle

ANS: 4

PTS: 2  
REF: 061206a2  
STA: A2.A.60

TOP: Unit Circle
\(-300^\circ + 360^\circ = 60^\circ\), which terminates in Quadrant I.

PTS: 2  REF: 011602a2  STA: A2.A.60  TOP: Unit Circle

If \(\csc P > 0\), \(\sin P > 0\). If \(\cot P < 0\) and \(\sin P > 0\), \(\cos P < 0\)

PTS: 2  REF: 061320a2  STA: A2.A.60  TOP: Finding the Terminal Side of an Angle

\(\cot P = \frac{-3}{2}\) \(\sin P = \frac{1}{2}\).

PTS: 4  REF: 061312a2  STA: A2.A.60  TOP: Determining Trigonometric Functions

\(\theta = \sin^{-1}\left(\frac{1}{2}\right)\) \(\theta = \cos^{-1}\left(-\frac{3}{5}\right)\) 

PTS: 2  REF: 011520a2  STA: A2.A.62  TOP: Determining Trigonometric Functions

\(\theta = \cot^{-1}\left(-\frac{3}{2}\right)\) 

PTS: 2  REF: 061525a2  STA: A2.A.62  TOP: Determining Trigonometric Functions

\(\theta = \sec^{-1}\left(-\frac{5}{3}\right)\) 

PTS: 4  REF: 011621a2  STA: A2.A.62  TOP: Determining Trigonometric Functions
461 \quad \text{ANS: } 2

\[
\tan(126^\circ 43') \\
-1.340788784
\]

PTS: 2 \quad \text{REF: } 061115a2 \quad \text{STA: } A2.A.66 \quad \text{TOP: Determining Trigonometric Functions}

462 \quad \text{ANS: } 1

\[
\cos\left(\frac{5\pi}{6}\right) \\
-1.154700538
\]

PTS: 2 \quad \text{REF: } 011203a2 \quad \text{STA: } A2.A.66 \quad \text{TOP: Determining Trigonometric Functions}

463 \quad \text{ANS: } 4

\[
\sin(138^\circ 20') \\
1.505698217
\]

PTS: 2 \quad \text{REF: } 061217a2 \quad \text{STA: } A2.A.66 \quad \text{TOP: Determining Trigonometric Functions}

464 \quad \text{ANS: } 3 \quad \text{PTS: } 2 \quad \text{REF: } 081007a2 \quad \text{STA: } A2.A.64 \quad \text{TOP: Using Inverse Trigonometric Functions} \quad \text{KEY: basic}

465 \quad \text{ANS: } 3 \quad \text{PTS: } 2 \quad \text{REF: } 011104a2 \quad \text{STA: } A2.A.64 \quad \text{TOP: Using Inverse Trigonometric Functions} \quad \text{KEY: unit circle}

466 \quad \text{ANS: } 1 \quad \text{PTS: } 2 \quad \text{REF: } 011112a2 \quad \text{STA: } A2.A.64 \quad \text{TOP: Using Inverse Trigonometric Functions} \quad \text{KEY: advanced}

467 \quad \text{ANS: } 2

\[
\tan 30 = \frac{\sqrt{3}}{3} \quad \text{Arc} \cos \frac{\sqrt{3}}{k} = 30
\]

\[
\frac{\sqrt{3}}{k} = \cos 30
\]

\[
k = 2
\]

PTS: 2 \quad \text{REF: } 061323a2 \quad \text{STA: } A2.A.64 \quad \text{TOP: Using Inverse Trigonometric Functions} \quad \text{KEY: advanced}
If $\sin A = -\frac{7}{25}$, $\cos A = \frac{24}{25}$, and $\tan A = \frac{\sin A}{\cos A} = \frac{-7}{24}$.

\[ \text{PTS: 2} \quad \text{REF: 011413a2} \quad \text{STA: A2.A.64} \quad \text{TOP: Using Inverse Trigonometric Functions} \]

If $\sin \theta = \frac{15}{17}$, then $\cos \theta = \frac{8}{17}$. $\tan \theta = \frac{8}{15}$. $\frac{17}{15} = \frac{8}{15}$.

\[ \text{PTS: 2} \quad \text{REF: 081508a2} \quad \text{STA: A2.A.64} \quad \text{TOP: Using Inverse Trigonometric Functions} \]

\[ \cos(-305^\circ + 360^\circ) = \cos(55^\circ) \]

\[ \text{PTS: 2} \quad \text{REF: 061104a2} \quad \text{STA: A2.A.57} \quad \text{TOP: Reference Angles} \]

\[ s = \theta r = 2 \cdot 4 = 8 \]

\[ \text{PTS: 2} \quad \text{REF: fall0922a2} \quad \text{STA: A2.A.61} \quad \text{TOP: Arc Length} \]

\[ s = \theta r = \frac{2\pi}{8} \cdot 6 = \frac{3\pi}{2} \]

\[ \text{PTS: 2} \quad \text{REF: 061212a2} \quad \text{STA: A2.A.61} \quad \text{TOP: Arc Length} \]

83°50'|| $\frac{\pi}{180}$ ≈ 1.463 radians $s = \theta r = 1.463 \cdot 12 \approx 17.6$

\[ \text{PTS: 2} \quad \text{REF: 011435a2} \quad \text{STA: A2.A.61} \quad \text{TOP: Arc Length} \]

\[ s = \theta r = \frac{2\pi}{5} \cdot 18 \approx 23 \]

\[ \text{PTS: 2} \quad \text{REF: 011526a2} \quad \text{STA: A2.A.61} \quad \text{TOP: Arc Length} \]
476 ANS: 
\[ r = \frac{6.6}{\frac{2}{3}} = 9.9 \]

PTS: 2 REF: 081532a2 STA: A2.A.61 TOP: Arc Length
KEY: radius

477 ANS: 3
\[ s = \theta r = \frac{4\pi}{3} \cdot \frac{24}{2} = 16\pi \]

PTS: 2 REF: 011611a2 STA: A2.A.61 TOP: Arc Length
KEY: arc length

478 ANS: 3
Cofunctions tangent and cotangent are complementary

479 ANS: 3
\[ \frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta \]

PTS: 2 REF: 061014a2 STA: A2.A.58 TOP: Cofunction Trigonometric Relationships

480 ANS: 
\[ \cos \theta \cdot \frac{1}{\cos \theta} - \cos^2 \theta = 1 - \cos^2 \theta = \sin^2 \theta \]

PTS: 2 REF: 061123a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

481 ANS: 
\[ a + 15 + 2a = 90 \]
\[ 3a + 15 = 90 \]
\[ 3a = 75 \]
\[ a = 25 \]

PTS: 2 REF: 011330a2 STA: A2.A.58 TOP: Cofunction Trigonometric Relationships

482 ANS: 
\[ \frac{\cot x \sin x}{\sec x} = \frac{\cos x}{\sin x} \cdot \frac{\sin x}{\sin x} = \cos^2 x \]

PTS: 2 REF: 061334a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships
\[
\frac{\cot x}{\csc x} = \frac{\cos x}{1} = \cos x
\]

\[
\sin^2 x \left(1 + \frac{\cos^2 x}{\sin^2 x}\right) = \sin^2 x + \cos^2 x = 1 - \frac{1}{\cos^2 x} (\cos^2 x) = 1 \cos^2 x \left(\frac{\sin^2 x}{\cos^2 x} - 1\right) = \sin^2 x - \cos^2 x \neq 1
\]

\[
\frac{\cos^2 x}{\sin^2 x} \left(\frac{1}{\cos^2 x} - 1\right) = \frac{1}{\sin^2 x} - \frac{\cos^2 x}{\sin^2 x} = \csc^2 x - \cot x = 1
\]

\[
\frac{1}{\cos^2 x} - 1 \quad \frac{\cos^2 x}{\sin^2 x} = \frac{1 - \cos^2 x}{\sin^2 x} = \sin^2 x
\]

Cofunctions secant and cosecant are complementary

\[
\frac{\sin 120}{2} = \frac{\sqrt{3}}{2}, \text{ then } \csc 120 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}
\]

\[
\sin 120 = \frac{\sqrt{3}}{2} \quad \csc 120 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}
\]

\[
\sin^2 A + \cos^2 A = \frac{1}{\cos^2 A + \cos^2 A} = 1
\]

\[
\tan^2 A + 1 = \sec^2 A
\]
\section*{Proving Trigonometric Identities}

491 ANS:
\[
\sec \theta \sin \theta \cot \theta = \frac{1}{\cos \theta} \cdot \sin \theta \cdot \frac{\cos \theta}{\sin \theta} = 1
\]

PTS: 2 \hspace{1cm} REF: 011428a2 \hspace{1cm} STA: A2.A.67 \hspace{1cm} TOP: Proving Trigonometric Identities

492 ANS:
\[
\frac{1}{\sin \theta} \cdot \sin^2 \theta \cdot \frac{\cos \theta}{\sin \theta} = \cos \theta
\]
\[
\cos \theta = \cos \theta
\]

PTS: 2 \hspace{1cm} REF: 011634a2 \hspace{1cm} STA: A2.A.67 \hspace{1cm} TOP: Proving Trigonometric Identities

493 ANS: 3

494 ANS:
\[
\frac{23}{2} \cos^2 B + \sin^2 B = 1
\]
\[
\cos^2 B + \left(\frac{5}{\sqrt{41}}\right)^2 = 1
\]
\[
\cos^2 B + \frac{25}{41} = \frac{41}{41}
\]
\[
\cos^2 B = \frac{16}{41}
\]
\[
\cos B = \frac{4}{\sqrt{41}}
\]

PTS: 4 \hspace{1cm} REF: 081037a2 \hspace{1cm} STA: A2.A.76 \hspace{1cm} TOP: Angle Sum and Difference Identities

KEY: simplifying

495 ANS:
\[
\sin(45 + 30) = \sin 45 \cos 30 + \cos 45 \sin 30
\]
\[
= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \frac{\sqrt{6} + \sqrt{2}}{4}
\]

PTS: 4 \hspace{1cm} REF: 061136a2 \hspace{1cm} STA: A2.A.76 \hspace{1cm} TOP: Angle Sum and Difference Identities

KEY: evaluating

496 ANS: 1
\[
\cos(A - B) = \left(\frac{5}{13}\right)\left(-\frac{3}{5}\right) + \left(\frac{12}{13}\right)\left(\frac{4}{5}\right) = -\frac{15}{65} + \frac{48}{65} = \frac{33}{65}
\]

PTS: 2 \hspace{1cm} REF: 011214a2 \hspace{1cm} STA: A2.A.76 \hspace{1cm} TOP: Angle Sum and Difference Identities

KEY: evaluating
\[ \sin(180 + x) = (\sin 180)(\cos x) + (\cos 180)(\sin x) = 0 + (-\sin x) = -\sin x \]

**498** ANS: 4
\[ \sin(\theta + 90) = \sin \theta \cdot \cos 90 + \cos \theta \cdot \sin 90 = \sin \theta \cdot (0) + \cos \theta \cdot (1) = \cos \theta \]

**499** ANS: 2
\[ \cos(x - y) = \cos x \cos y + \sin x \sin y \\
= b \cdot b + a \cdot a \\
= b^2 + a^2 \]

**500** ANS: 1
\[ \cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta \]

**501** ANS: 3
\[ \left( \frac{2}{3} \right)^2 + \cos^2 A = 1 \quad \sin 2A = 2 \sin A \cos A \]
\[ \cos^2 A = \frac{5}{9} \quad = 2 \left( \frac{2}{3} \right) \left( \frac{\sqrt{5}}{3} \right) \quad \cos A = \frac{\sqrt{5}}{3} \text{, sin } A \text{ is acute.} \quad = \frac{4\sqrt{5}}{9} \]

**502** ANS: 1
If \( \sin x = 0.8 \), then \( \cos x = 0.6 \). \[ \tan \frac{1}{2} x = \sqrt{\frac{1 - 0.6}{1 + 0.6}} = \sqrt{\frac{0.4}{1.6}} = 0.5. \]

**503** ANS: 4
\[ \cos 2A = 1 - 2\sin^2 A = 1 - 2\left( \frac{1}{3} \right)^2 = 1 - \frac{2}{9} = 7 \]

**504** ANS: 1
\[ \cos (\theta + 90) = \cos \theta \cdot \cos 90 + \sin \theta \cdot \sin 90 = \frac{\sqrt{3}}{2} \cdot (0) + \frac{1}{2} \cdot (1) = \frac{1}{2} \]

**505** ANS: 3
\[ \sec^2 \theta - \tan^2 x = \frac{1}{\cos^2 \theta} - \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1 - \sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta \]

**506** ANS: 4
\[ \tan(\theta - 30) = \frac{\tan \theta - \sqrt{3}}{1 + \tan \theta \cdot \sqrt{3}} = \frac{\tan \theta - \frac{\sqrt{3}}{3}}{1 + \frac{\sqrt{3}}{3} \cdot \tan \theta} = \frac{\tan \theta - \sqrt{3}}{3 + \sqrt{3} \cdot \tan \theta} \]

**507** ANS: 1
\[ \sin(\theta + \phi) = \sin \theta \cos \phi + \cos \theta \sin \phi \]

**508** ANS: 2
\[ \tan(\theta + \phi) = \frac{\tan \theta + \tan \phi}{1 - \tan \theta \cdot \tan \phi} \]

**509** ANS: 3
\[ \sin(\theta + \phi) = \sin \theta \cos \phi + \cos \theta \sin \phi \]

**510** ANS: 4
\[ \cos(\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi \]

**511** ANS: 1
\[ \sec^2 \theta - \tan^2 \theta = \frac{1}{\cos^2 \theta} - \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1 - \sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta \]

**512** ANS: 3
\[ \tan(\theta + \phi) = \frac{\tan \theta + \tan \phi}{1 - \tan \theta \cdot \tan \phi} \]

**513** ANS: 4
\[ \cos(\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi \]

**514** ANS: 1
\[ \sec^2 \theta - \tan^2 \theta = \frac{1}{\cos^2 \theta} - \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1 - \sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta \]

**515** ANS: 3
\[ \tan(\theta + \phi) = \frac{\tan \theta + \tan \phi}{1 - \tan \theta \cdot \tan \phi} \]

**516** ANS: 4
\[ \cos(\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi \]

**517** ANS: 1
\[ \sec^2 \theta - \tan^2 \theta = \frac{1}{\cos^2 \theta} - \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1 - \sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta \]

**518** ANS: 3
\[ \tan(\theta + \phi) = \frac{\tan \theta + \tan \phi}{1 - \tan \theta \cdot \tan \phi} \]

**519** ANS: 4
\[ \cos(\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi \]

**520** ANS: 1
\[ \sec^2 \theta - \tan^2 \theta = \frac{1}{\cos^2 \theta} - \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1 - \sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta \]

**521** ANS: 3
\[ \tan(\theta + \phi) = \frac{\tan \theta + \tan \phi}{1 - \tan \theta \cdot \tan \phi} \]

**522** ANS: 4
\[ \cos(\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi \]
\[ \cos 2A = 1 - 2 \sin^2 A = 1 - 2 \left( \frac{3}{8} \right)^2 = \frac{32}{32} - \frac{9}{32} = \frac{23}{32} \]

\[ \frac{1 + \cos 2A}{\sin 2A} = \frac{1 + 2 \cos^2 A - 1}{2 \sin A \cos A} = \frac{\cos A}{\sin A} = \cot A \]

\[ \cos 2\theta = 2 \left( \frac{3}{4} \right)^2 - 1 = 2 \left( \frac{9}{16} \right) - 1 = \frac{9}{8} - \frac{8}{8} = \frac{1}{8} \]

\[ \tan \theta - \sqrt{3} = 0 \]

\[ \tan \theta = \sqrt{3} \]

\[ \theta = \tan^{-1} \sqrt{3} \]

\[ \theta = 60, 240 \]
\[ \sin 2\theta = \sin \theta \]
\[ 2 \sin \theta \cos \theta - \sin \theta = 0 \]
\[ \sin \theta (2 \cos \theta - 1) = 0 \]
\[ \sin \theta = 0, \ 2 \cos \theta - 1 = 0 \]
\[ \theta = 0, 180, \cos \theta = \frac{1}{2} \]
\[ \theta = 60, 300 \]

**ANS:**
0, 60, 180, 300.

**PTS:** 4
**REF:** 061037a2
**STA:** A2.A.68
**TOP:** Trigonometric Equations
**KEY:** double angle identities

\[ 2 \tan C - 3 = 3 \tan C - 4 \]
\[ 1 = \tan C \]
\[ \tan^{-1} 1 = C \]
\[ C = 45, 225 \]

**ANS:**
45, 225

**PTS:** 2
**REF:** 081032a2
**STA:** A2.A.68
**TOP:** Trigonometric Equations
**KEY:** basic

\[ 2 \cos \theta = 1 \]
\[ \cos \theta = \frac{1}{2} \]
\[ \theta = \cos^{-1} \frac{1}{2} = 60, 300 \]

**ANS:**
4

**PTS:** 2
**REF:** 061203a2
**STA:** A2.A.68
**TOP:** Trigonometric Equations
**KEY:** basic
\[ -\sqrt{2} \sec x = 2 \]
\[ \sec x = \frac{2}{\sqrt{2}} \]
\[ \cos x = -\frac{\sqrt{2}}{2} \]
\[ x = 135, 225 \]

512 ANS:
\[ 5 \csc \theta = 8 \]
\[ \csc \theta = \frac{8}{5} \]
\[ \sin \theta = \frac{5}{8} \]
\[ \theta \approx 141 \]

513 ANS:
\[ 2 \sin^2 x + 5 \sin x - 3 = 0 \]
\[ (2 \sin x - 1)(\sin x + 3) = 0 \]
\[ \sin x = \frac{1}{2} \]
\[ x = \frac{\pi}{6}, \frac{5\pi}{6} \]

514 ANS:
\[ \sec x = \sqrt{2} \]
\[ \cos x = \frac{1}{\sqrt{2}} \]
\[ \cos x = \frac{\sqrt{2}}{2} \]
\[ x = 45^\circ, 315^\circ \]
515 ANS:

\[ 5 \cos \theta - 2 \sec \theta + 3 = 0 \]
\[ 5 \cos \theta - \frac{2}{\cos \theta} + 3 = 0 \]
\[ 5 \cos^2 \theta + 3 \cos \theta - 2 = 0 \]
\[ (5 \cos \theta - 2)(\cos \theta + 1) = 0 \]
\[ \cos \theta = \frac{2}{5}, -1 \]
\[ \theta \approx 66.4, 293.6, 180 \]

PTS: 6 REF: 061539a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: reciprocal functions

516 ANS: 2

\[ (2 \sin x - 1)(\sin x + 1) = 0 \]
\[ \sin x = \frac{1}{2}, -1 \]
\[ x = 30, 150, 270 \]

PTS: 2 REF: 081514a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: quadratics

517 ANS:

\[ 2 \cos^2 x - 1 = \cos x \]
\[ 2 \cos^2 x - \cos x - 1 = 0 \]
\[ (2 \cos x + 1)(\cos x - 1) = 0 \]
\[ \cos x = -\frac{1}{2}, 1 \]
\[ x = 0, 120, 240 \]

PTS: 4 REF: 011638a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: double angle identities

518 ANS: 4

\[ \frac{2\pi}{b} = \frac{2\pi}{1} = 6\pi \]

PTS: 2 REF: 061027a2 STA: A2.A.69 TOP: Properties of Graphs of Trigonometric Functions
KEY: period
\[
\frac{2\pi}{b} = \frac{2\pi}{3}
\]

PTS: 2      REF: 061111a2      STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions       KEY: period

\[
\frac{2\pi}{b} = 4\pi
\]

\[
b = \frac{1}{2}
\]

PTS: 2      REF: 011425a2      STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions       KEY: period

\[
\frac{2\pi}{6} = \frac{\pi}{3}
\]

PTS: 2      REF: 061413a2      STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions       KEY: period

\[
\frac{2\pi}{2} = \pi
\]

\[
\frac{\pi}{\pi} = 1
\]

PTS: 2      REF: 061519a2      STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions       KEY: period

\[
\frac{2\pi}{2} = \pi
\]

PTS: 2      REF: 081519a2      STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions       KEY: period

\[
\frac{2\pi}{b} = 30
\]

\[
b = \frac{\pi}{15}
\]

PTS: 2      REF: 011227a2      STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph
526 ANS: 
\[ y = -3 \sin 2x. \] The period of the function is \( \pi \), the amplitude is 3 and it is reflected over the \( x \)-axis.

PTS: 2 REF: 061235a2 STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

527 ANS: 1
PTS: 2 REF: 011320a2 STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

528 ANS: 3
PTS: 2 REF: 061306a2 STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

529 ANS:
\[ a = 3, \quad b = 2, \quad c = 1 \quad y = 3 \cos 2x + 1. \]

PTS: 2 REF: 011538a2 STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

530 ANS: 3
PTS: 2 REF: fall0913a2 STA: A2.A.65
TOP: Graphing Trigonometric Functions

531 ANS: 3
PTS: 2 REF: 061119a2 STA: A2.A.65
TOP: Graphing Trigonometric Functions

532 ANS: 3
\[ \text{period} = \frac{2\pi}{b} = \frac{2\pi}{3} = \frac{2}{3} \]

PTS: 2 REF: 081026a2 STA: A2.A.70 TOP: Graphing Trigonometric Functions
KEY: recognize

533 ANS: 3

\[ \text{Plot}\text{1}\text{ Plot2 Plot3} \]

\[ y = \cos (x) \]

\[ y = \sin (x) \]

\[ y = 1 \]

\[ y = -1 \]

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535 \text{ANS: 3} \\
\text{PTS: 2} \quad \text{REF: 011207a2} \quad \text{STA: A2.A.71} \quad \text{TOP: Graphing Trigonometric Functions}

536 \text{ANS: 3} \quad \text{PTS: 2} \quad \text{REF: 061022a2} \quad \text{STA: A2.A.63} \\
\text{TOP: Domain and Range}

537 \text{ANS: 3} \quad \text{PTS: 2} \quad \text{REF: 061224a2} \quad \text{STA: A2.A.63} \\
\text{TOP: Domain and Range}

538 \text{ANS: 4} \quad \text{PTS: 2} \quad \text{REF: 061427a2} \quad \text{STA: A2.A.63} \\
\text{TOP: Domain and Range}

539 \text{ANS: 4} \quad \text{PTS: 2} \quad \text{REF: 011622a2} \quad \text{STA: A2.A.63} \\
\text{TOP: Domain and Range}

540 \text{ANS: 2} \\
K = \frac{1}{2} (10)(18) \sin 120 = 45\sqrt{3} \approx 78 \\
\text{PTS: 2} \quad \text{REF: fall0907a2} \quad \text{STA: A2.A.74} \quad \text{TOP: Using Trigonometry to Find Area} \\
\text{KEY: basic}

541 \text{ANS:} \\
K = ab \sin C = 24 \cdot 30 \sin 57 \approx 604 \\
\text{PTS: 2} \quad \text{REF: 061034a2} \quad \text{STA: A2.A.74} \quad \text{TOP: Using Trigonometry to Find Area} \\
\text{KEY: parallelograms}

542 \text{ANS: 3} \\
K = (10)(18) \sin 46 \approx 129 \\
\text{PTS: 2} \quad \text{REF: 081021a2} \quad \text{STA: A2.A.74} \quad \text{TOP: Using Trigonometry to Find Area} \\
\text{KEY: parallelograms}

543 \text{ANS: 1} \\
\frac{1}{2} (7.4)(3.8) \sin 126 \approx 11.4 \\
\text{PTS: 2} \quad \text{REF: 011218a2} \quad \text{STA: A2.A.74} \quad \text{TOP: Using Trigonometry to Find Area} \\
\text{KEY: basic}

544 \text{ANS:} \\
K = ab \sin C = 18 \cdot 22 \sin 60 = 396 \cdot \frac{\sqrt{3}}{2} = 198\sqrt{3} \\
\text{PTS: 2} \quad \text{REF: 061234a2} \quad \text{STA: A2.A.74} \quad \text{TOP: Using Trigonometry to Find Area} \\
\text{KEY: parallelograms}
\[42 = \frac{1}{2} (a)(8) \sin 61\]
\[42 \approx 3.5a\]
\[12 \approx a\]

**PTS: 2**  
**KEY: basic**  
**REF: 011316a2**  
**STA: A2.A.74**  
**TOP: Using Trigonometry to Find Area**

\[\frac{15}{\sin 103} = \frac{a}{\sin 42} \cdot \frac{1}{2} (15)(10.3) \sin 35 \approx 44\]
\[a \approx 10.3\]

**PTS: 4**  
**KEY: advanced**  
**REF: 061337a2**  
**STA: A2.A.74**  
**TOP: Using Trigonometry to Find Area**

\[K = ab \sin C = 6 \cdot 6 \sin 50 \approx 27.6\]

**PTS: 2**  
**KEY: parallelograms**  
**REF: 011429a2**  
**STA: A2.A.74**  
**TOP: Using Trigonometry to Find Area**

\[\frac{1}{2} (22)(13) \sin 55 \approx 117\]

**PTS: 2**  
**KEY: basic**  
**REF: 061403a2**  
**STA: A2.A.74**  
**TOP: Using Trigonometry to Find Area**

\[\frac{594}{1472} = \sin C\]
\[23.8 \approx C\]

**PTS: 2**  
**KEY: parallelograms**  
**REF: 011535a2**  
**STA: A2.A.74**  
**TOP: Using Trigonometry to Find Area**

\[K = 8 \cdot 12 \sin 120 = 96 \cdot \frac{\sqrt{3}}{2} = 48\sqrt{3}\]

**PTS: 2**  
**KEY: parallelograms**  
**REF: 061508a2**  
**STA: A2.A.74**  
**TOP: Using Trigonometry to Find Area**
\[
\frac{1}{2} \cdot 15 \cdot 31.6 \sin 125 \approx 194
\]

PTS: 2  REF: 011633a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area  KEY: advanced

\[
\frac{12}{\sin 32} = \frac{10}{\sin B} \quad \therefore \quad C \approx 180 - (32 + 26.2) \approx 121.8. \quad \frac{12}{\sin 32} = \frac{c}{\sin 121.8}
\]

\[
B = \sin^{-1} \left( \frac{10 \sin 32}{12} \right) \approx 26.2
\]

\[
c = \frac{12 \sin 121.8}{\sin 32} \approx 19.2
\]

PTS: 4  REF: 011137a2  STA: A2.A.73  TOP: Law of Sines  KEY: basic

\[
\frac{100}{\sin 33} = \frac{x}{\sin 32}. \quad \sin 66 \approx \frac{T}{97.3}
\]

\[
x \approx 97.3 \quad t \approx 88
\]


\[
\frac{100}{\sin 32} = \frac{b}{\sin 105}. \quad \frac{100}{\sin 32} = \frac{a}{\sin 43}
\]

\[
b \approx 182.3 \quad a \approx 128.7
\]

PTS: 4  REF: 011338a2  STA: A2.A.73  TOP: Law of Sines  KEY: basic

\[
\frac{16}{\sin A} = \frac{15}{\sin 40}. \quad \frac{10}{\sin 50} = \frac{12}{\sin C}. \quad \frac{d}{\sin 63.2} = \frac{12}{\sin 66.8}
\]

\[
\sin A = \frac{16 \sin 40}{15} \quad \sin C = \frac{12 \sin 50}{10} \quad d = \frac{12 \sin 63.2}{\sin 66.8}
\]

\[
A \approx 43.3 \quad C \approx 66.8 \quad d \approx 11.7
\]


\[
\frac{59.2}{\sin 74} = \frac{60.3}{\sin C}. \quad 180 - 78.3 = 101.7
\]

\[
C \approx 78.3
\]

PTS: 2  REF: 081006a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case
\[
\frac{10}{\sin 35} = \frac{13}{\sin B} \quad \text{or} \quad 35 + 48 < 180 \\
B \approx 48, 132 \quad 35 + 132 < 180
\]

PTS: 2 
REF: 011113a2 
STA: A2.A.75 
TOP: Law of Sines - The Ambiguous Case

\[
\frac{9}{\sin A} = \frac{10}{\sin 70} \\
58^\circ + 70^\circ \text{ is possible. } 122^\circ + 70^\circ \text{ is not possible.} \\
A \approx 58
\]

PTS: 2 
REF: 011210a2 
STA: A2.A.75 
TOP: Law of Sines - The Ambiguous Case

\[
\frac{6}{\sin 35} = \frac{10}{\sin N} \\
N \approx 73 \\
73 + 35 < 180 \\
(180 - 73) + 35 < 180
\]

PTS: 2 
REF: 061226a2 
STA: A2.A.75 
TOP: Law of Sines - The Ambiguous Case

\[
\frac{13}{\sin 40} = \frac{20}{\sin M} \\
81 + 40 < 180. \ (180 - 81) + 40 < 180 \\
M \approx 81
\]

PTS: 2 
REF: 061327a2 
STA: A2.A.75 
TOP: Law of Sines - The Ambiguous Case

\[
\frac{5}{\sin 32} = \frac{8}{\sin E} \\
57.98 + 32 < 180 \\
E \approx 57.98 \quad (180 - 57.98) + 32 < 180
\]

PTS: 2 
REF: 011419a2 
STA: A2.A.75 
TOP: Law of Sines - The Ambiguous Case

\[
\frac{\sqrt{34}}{\sin 30} = \frac{12}{\sin B} \\
B = \sin^{-1} \frac{12 \sin 30}{\sqrt{34}} \\
\approx \sin^{-1} \frac{6}{5.8}
\]

PTS: 2 
REF: 011523a2 
STA: A2.A.75 
TOP: Law of Sines - The Ambiguous Case
\[
\frac{8}{\sin 85} = \frac{2}{\sin C}
\]
\[
85 + 14.4 < 180 \quad \text{1 triangle}
\]
\[
C = \sin^{-1} \left( \frac{\frac{2 \sin 85}{8}}{85 + 165.6 \geq 180} \right)
\]
\[
C \approx 14.4
\]

PTS: 2  
REF: 061529a2  
STA: A2.A.75  
TOP: Law of Sines - The Ambiguous Case

\[
a = \sqrt{10^2 + 6^2 - 2(10)(6)\cos 80} \approx 10.7. \quad \angle C \text{ is opposite the shortest side.}
\]
\[
\frac{6}{\sin C} = \frac{10.7}{\sin 80}
\]
\[
C \approx 33
\]

ANS:

565

PTS: 6  
REF: 061039a2  
STA: A2.A.73  
TOP: Law of Cosines  
KEY: advanced

\[
7^2 = 3^2 + 5^2 - 2(3)(5)\cos A
\]
\[
49 = 34 - 30\cos A
\]
\[
15 = -30\cos A
\]
\[
\frac{1}{2} = \cos A
\]
\[
120 = A
\]

PTS: 2  
REF: 081017a2  
STA: A2.A.73  
TOP: Law of Cosines  
KEY: angle, without calculator

\[
13^2 = 15^2 + 14^2 - 2(15)(14)\cos C
\]
\[
169 = 421 - 420\cos C
\]
\[
-252 = -420\cos C
\]
\[
\frac{252}{420} = \cos C
\]
\[
53 \approx C
\]

PTS: 2  
REF: 061110a2  
STA: A2.A.73  
TOP: Law of Cosines  
KEY: find angle

\[
\sqrt{27^2 + 32^2 - 2(27)(32)\cos 132} \approx 54
\]

PTS: 4  
REF: 011438a2  
STA: A2.A.73  
TOP: Law of Cosines  
KEY: applied
\[
28^2 = 47^2 + 34^2 - 2(47)(34)\cos A \\
784 = 3365 - 3196\cos A \\
-2581 = -3196\cos A \\
\frac{2581}{3196} = \cos A \\
36 \approx A
\]

\[
a = \sqrt{8^2 + 11^2 - 2(8)(11)\cos 82} \approx 12.67. \text{ The angle opposite the shortest side: } \frac{8}{\sin x} = \frac{12.67}{\sin 82} \\
x \approx 38.7
\]

\[
\frac{2.5}{\sin x} = \frac{101.43}{\sin 125} \\
x \approx 12
\]
\[
\frac{27}{\sin 75^\circ} = \frac{F_1}{\sin 60^\circ}, \quad \frac{27}{\sin 75^\circ} = \frac{F_2}{\sin 45^\circ}.
\]

\[
F_1 \approx 24, \quad F_2 \approx 20.
\]

\[
\text{PTS: 4} \quad \text{REF: 061238a2} \quad \text{STA: A2.A.73} \quad \text{TOP: Vectors}
\]

\[
R = \sqrt{28^2 + 40^2 - 2(28)(40)\cos 115^\circ} \approx 58, \quad \frac{58}{\sin 115^\circ} = \frac{40}{\sin x}, \quad x \approx 39.
\]

\[
\text{PTS: 6} \quad \text{REF: 061439a2} \quad \text{STA: A2.A.73} \quad \text{TOP: Vectors}
\]

\[
x^2 - 2x + y^2 + 6y = -3
\]
\[
x^2 - 2x + 1 + y^2 + 9 = -3 + 1 + 9
\]
\[
(x - 1)^2 + (y + 3)^2 = 7
\]

\[
\text{PTS: 2} \quad \text{REF: 061016a2} \quad \text{STA: A2.A.47} \quad \text{TOP: Equations of Circles}
\]

\[
x^2 + y^2 - 16x + 6y + 53 = 0
\]
\[
x^2 - 16x + 64 + y^2 + 6y + 9 = -53 + 64 + 9
\]
\[
(x - 8)^2 + (y + 3)^2 = 20
\]

\[
\text{PTS: 2} \quad \text{REF: 011415a2} \quad \text{STA: A2.A.47} \quad \text{TOP: Equations of Circles}
\]

\[
r = \sqrt{(6 - 3)^2 + (5 - (-4))^2} = \sqrt{9 + 81} = \sqrt{90}
\]

\[
\text{PTS: 2} \quad \text{REF: 061415a2} \quad \text{STA: A2.A.48} \quad \text{TOP: Equations of Circles}
\]

\[
r = \sqrt{(6 - 2)^2 + (2 - (-3))^2} = \sqrt{16 + 25} = \sqrt{41}
\]

\[
\text{PTS: 2} \quad \text{REF: 081516a2} \quad \text{STA: A2.A.48} \quad \text{TOP: Equations of Circles}
\]

\[
r = \sqrt{(3 - 0)^2 + (-5 - (-2))^2} = \sqrt{9 + 9} = \sqrt{18}
\]

\[
\text{PTS: 2} \quad \text{REF: 011624a2} \quad \text{STA: A2.A.48} \quad \text{TOP: Equations of Circles}
\]
580  ANS:  
\[(x + 3)^2 + (y - 4)^2 = 25\]

PTS:  2             REF:  fall0929a2    STA:  A2.A.49    TOP:  Writing Equations of Circles

581  ANS:  
\[(x + 5)^2 + (y - 3)^2 = 32\]

PTS:  2             REF:  081033a2    STA:  A2.A.49    TOP:  Writing Equations of Circles

582  ANS:  
\[r = \sqrt{2^2 + 3^2} = \sqrt{13}. \quad (x + 5)^2 + (y - 2)^2 = 13\]

PTS:  2             REF:  011234a2    STA:  A2.A.49    TOP:  Writing Equations of Circles

583  ANS:  
\[r = \sqrt{2^2 + 3^2} = \sqrt{13}. \quad (x + 5)^2 + (y - 2)^2 = 13\]

PTS:  2             REF:  011234a2    STA:  A2.A.49    TOP:  Writing Equations of Circles

584  ANS:  
\[r = \sqrt{2^2 + 3^2} = \sqrt{13}. \quad (x + 5)^2 + (y - 2)^2 = 13\]

PTS:  2             REF:  011513a2    STA:  A2.A.49    TOP:  Writing Equations of Circles

585  ANS:  
\[r = \sqrt{2^2 + 3^2} = \sqrt{13}. \quad (x + 5)^2 + (y - 2)^2 = 13\]

PTS:  2             REF:  011513a2    STA:  A2.A.49    TOP:  Writing Equations of Circles