

1 The expression $\frac{2}{3}\sqrt{-108}$ is equivalent to

- $$\begin{array}{ll} 1) & -24\sqrt{3} \\ 2) & -4\sqrt{3} \end{array} \qquad \begin{array}{ll} 3) & 4i\sqrt{3} \\ 4) & 24i\sqrt{3} \end{array}$$

- 2 Which statement is true about the graph of $y = \sqrt{9 - 2x}$?
- 1) The x -intercept is $(4, 0)$.
2) The y -intercept is $(0, 3)$.
3) It is always increasing.
4) The y -values are always negative.

- 3 An exponential function that contains the points (0,20) and (1,10) is
- | | |
|-----------------------|-----------------------|
| 1) $f(x) = 10(2)^x$ | 3) $f(x) = 20(0.5)^x$ |
| 2) $f(x) = 10(0.5)^x$ | 4) $f(x) = 20(2)^x$ |

- 4 If A and B are two events such that $P(A \text{ and } B) = 0.2$, $P(A) = 0.3$, and $P(B) = 0.4$, what is $P(A \text{ or } B)$?
- | | |
|--------|--------|
| 1) 0.9 | 3) 0.5 |
| 2) 0.7 | 4) 0.1 |

- 5 Which value of x is in the solution set of $f(x) < g(x)$ if $f(x) = \sqrt[3]{x}$ and $g(x) = x^3 - 4x$?
- | | |
|------|-------|
| 1) 1 | 3) 0 |
| 2) 2 | 4) -1 |

- $$a_1 = 200$$

$$a_n = (0.8)a_{n-1}$$

The value of a_4 is

- 1) 202.4 3) 102.4
2) 159 4) 81.92

- 7 Antonella is solving a system of equations. Part of her work is shown below.

$$(x-4)^2 + (y+1)^2 = 25$$

$$y = -x + 4$$

Step 1: $(x-4)^2 + (-x+4+1)^2 = 25$

Step 2: $(x-4)^2 + (-x+5)^2 = 25$

Step 3: $x^2 - 8x + 16 - x^2 - 10x + 25 = 25$

Which statement best describes Antonella's work?

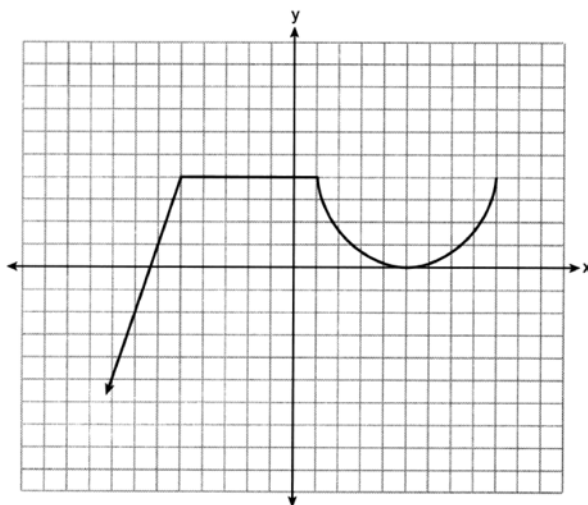
- 1) In step 1, she substituted incorrectly.
- 2) In step 2, she added incorrectly.
- 3) In step 3, she multiplied incorrectly.
- 4) Her work is correct.

- | | Math | Science | English | Social Studies | Total |
|----------------------------|------|---------|---------|----------------|-------|
| Have Pets at Home | 27 | 35 | 14 | 30 | 106 |
| Does Not Have Pets at Home | 52 | 49 | 28 | 15 | 144 |
| Total | 79 | 84 | 42 | 45 | 250 |

1) 0.208	3) 0.658
2) 0.316	4) 0.892

- 14 For the polynomial $p(x)$, it is determined that $p(5) = 0$. Which conclusion about $p(x)$ must be true?
- 1) $x - 5$ is a factor of $p(x)$.
 - 2) $x + 5$ is a factor of $p(x)$.
 - 3) When $p(x)$ is divided by 5 the remainder is 0.
 - 4) $x = -5$ is a zero of $p(x)$.
- 15 Given $\sin(\theta) = \frac{21}{29}$ and θ is an angle in standard position the terminates in Quadrant II, what is the value of $\tan(\theta)$?
- 1) $\frac{21}{20}$
 - 2) $-\frac{21}{20}$
 - 3) $-\frac{20}{29}$
 - 4) $\frac{29}{21}$
- 16 The solution set to the equation $\frac{6}{k} + \frac{k+2}{k+3} = \frac{2}{k^2+3k}$ is
- 1) $\{-3, 0\}$
 - 2) $\{-4\}$
 - 3) $\{-4, 4\}$
 - 4) $\{4\}$
- 17 The weights of 500 ketchup packets used by a restaurant chain are approximately normally distributed with a mean of 0.95 ounces and a standard deviation of 0.04 ounces. What is the approximate number of packets that weigh between 0.91 and 0.99 ounces?
- 1) 68
 - 2) 79
 - 3) 341
 - 4) 475
- 18 A school counselor wants to estimate the proportion of the 503 juniors at her school who plan to attend a SUNY school. The counselor surveys 50 randomly chosen juniors at her school to ask about their post-graduation plans and finds that 38% of them plan to attend a SUNY school. What is the parameter of interest?
- 1) the mean number of juniors who plan to attend a SUNY school
 - 2) the 38 students who responded yes to the survey
 - 3) the proportion of students who are not planning to attend a SUNY school
 - 4) the proportion of all juniors from this high school who plan to attend a SUNY school
- 19 The sport of pickleball has grown by 59% over the three years from 2020 to 2023. The equation $P(t) = 5.6(1.59)^{\frac{t}{3}}$ can be used to model the number of people in a city playing pickleball, where $P(t)$ is measured in millions of people and t is measured in years since 2020. In terms of the yearly growth rate, the number of pickleball players could best be approximated by
- 1) $P(t) = 5.6(1.167)^t$
 - 2) $P(t) = 5.6(1.167)^{3t}$
 - 3) $P(t) = 5.6(4.019)^t$
 - 4) $P(t) = 5.6(4.019)^{3t}$
- 20 The solutions to $\frac{x^2+7}{2} = -x$ are
- 1) $-1 \pm i\sqrt{6}$
 - 2) $-2 \pm i\sqrt{6}$
 - 3) $-1 \pm 2i\sqrt{6}$
 - 4) $-1 \pm i\sqrt{3}$

- 21 The completely factored form of the expression $x^6 - 63x^3 - 64$ is
- $(x - 64)(x + 1)$
 - $(x^3 - 64)(x^3 + 1)$
 - $(x + 8)(x - 8)(x + 1)(x - 1)$
 - $(x - 4)(x^2 + 4x + 16)(x + 1)(x^2 - x + 1)$
- 22 Which function is odd?
- $y = \sin(2x)$
 - $y = \sin(x) + 2$
 - $y = \cos(-x)$
 - $y = \cos(x)$
- 23 What is the inverse of $f(x) = 2^{x+1}$?
- $f^{-1}(x) = \log_2(x - 1)$
 - $f^{-1}(x) = \log_2(x) - 1$
 - $f^{-1}(x) = -2x^{x+1}$
 - $f^{-1}(x) = -2x^{-x+1}$
- 24 Given $a > 0$ and $b > 0$, which function's graph has a period of $4b$ and a maximum of $2a$?
- $y = \frac{3a}{2} \cos(4bx) + \frac{a}{2}$
 - $y = -\frac{3a}{2} \cos\left(\frac{\pi}{2b}x\right) + \frac{a}{2}$
 - $y = a \cos(4bx) + a$
 - $y = \cos\left(\frac{\pi}{2b}x\right) + 2a$
- 25 In order to keep the store properly stocked with produce, a grocery store manager wants to determine the most popular day of the week for people to buy apples and oranges. She randomly collects a sample of sales records for each day for three consecutive weeks. Is this type of data collection method a survey, an observational study, or an experiment? Explain your reasoning.
- 26 Given the following functions $f(x) = 2x^2 + 3x - 7$ and $g(x) = 2x - 5$, determine $f(x) - g(x)$, and express the result in standard form.
- 27 Determine algebraically the zeros of $f(x) = x^3 - 4x^2 - 9x + 36$.
- 28 The graph of $y = f(x)$ is shown below. On the same set of axes, graph $y = f(x + 3) - 4$.

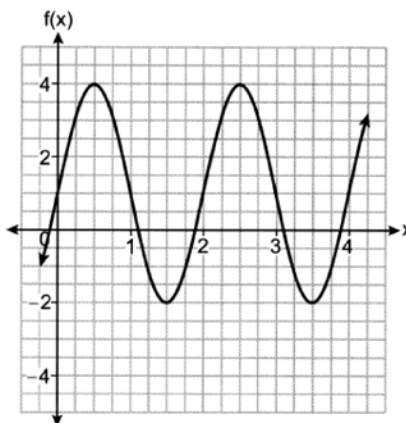


- 29 Express $(-2 + \sqrt{-25})^2$ in simplest $a + bi$ form. Justify your answer.
- 30 The most common radioactive form of cesium is cesium-137. The half-life of cesium-137 is 30 years. Suppose 2.7 micrograms of cesium-137 are found in a soil sample. Write a function for the amount of cesium-137 remaining, $c(t)$, in micrograms, in terms of the number of years, t , since the soil sample was taken.
- 31 Solve algebraically for x : $\sum_{a=0}^4 (ax - 3) = 5$
- 32 Given the exponential function $y = 5.381e^{0.214x}$, rewrite the function in the form of $y = a(b)^x$, rounding values to the nearest thousandth.
- 33 Determine the quotient and remainder of the expression below.

$$\frac{2x^4 - 27x^2 + 33x - 8}{x^2 + 3x - 5}$$

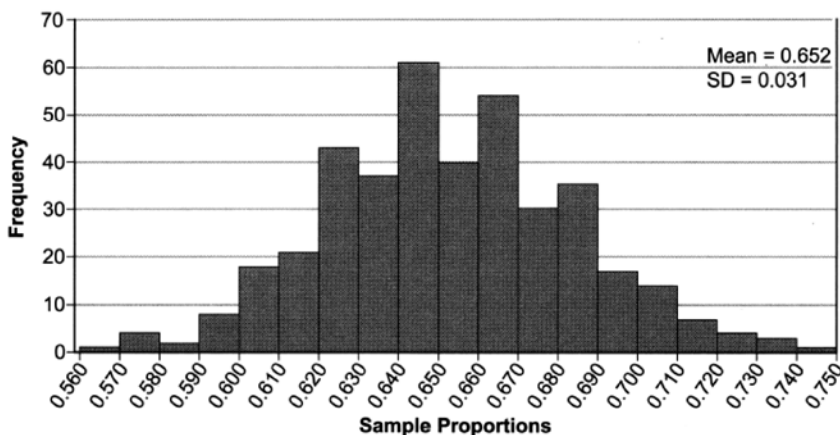
Express the result in the form $q(x) + \frac{r(x)}{d(x)}$.

- 34 The sinusoidal function f is graphed below.



State the period of the function f . State the amplitude of the function f . Write the equation in the form $f(x) = A \sin(Bx) + D$ to represent the sinusoidal function.

- 35 A principal wonders what percentage of parents at her large high school restrict their child's cell phone privileges. The school surveys a random sample of 250 parents at the school and finds that 65% of them restrict their child's cell phone privileges. The school runs a simulation with 400 samples of 250 parents, assuming that 65% of them restrict cell phone privileges. The simulation results are shown below.



Use the simulation to determine an interval containing the middle 95% of simulated proportions. Justify your answer. Round all values to the *nearest hundredth*. The school district's superintendent worries that less than half of parents restrict their child's cell phone privileges. Do the simulation results support the superintendent's concern? Explain.

- 36 Lubin pours green tea into a cup to cool. The function below can be used to model the temperature, in degrees Fahrenheit, of Lubin's tea x minutes after he pours it into the cup.

$$T(x) = 110e^{-0.0453x} + 74$$

State the temperature of the tea, in degrees Fahrenheit, when Lubin poured it into the cup. To the *nearest tenth*, use $T(x)$ to determine the average rate of change in degrees per minute, from $x = 0$ to $x = 5$. Interpret the value of the average rate of change within the given context. To the *nearest tenth of a minute*, determine how long Lubin must wait after pouring his tea into the cup before the tea's temperature reaches 120° Fahrenheit.

0826aii

Answer Section

1 ANS: 3

$$\frac{2}{3} \sqrt{-108} = \frac{2}{3} \sqrt{-36} \sqrt{3} = 4i\sqrt{3}$$

PTS: 2

REF: 082601aii

NAT: N.CN.A.2

TOP: Square Roots of Negative Numbers

KEY: simplify

2 ANS: 2

PTS: 2

REF: 082602aii

NAT: F.IF.C.7

TOP: Graphing Root Functions

3 ANS: 3

PTS: 2

REF: 082603aii

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

4 ANS: 3

$$.3 + .4 - .2 = .5$$

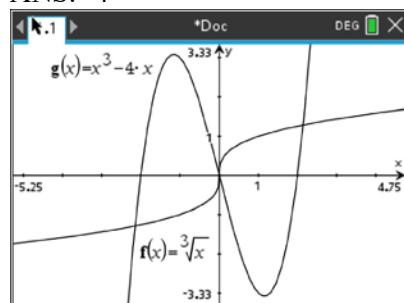
PTS: 2

REF: 082604aii

NAT: S.CP.B.7

TOP: Addition Rule

5 ANS: 4



PTS: 2

REF: 082605aii

NAT: A.REI.D.11

TOP: Other Systems

KEY: radical

6 ANS: 3

$$a_1 = 200 \quad a_2 = 160 \quad a_3 = 128 \quad a_4 = 102.4$$

PTS: 2

REF: 082606aii

NAT: F.IF.A.3

TOP: Sequences

KEY: recursive

7 ANS: 3

PTS: 2

REF: 082607aii

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

8 ANS: 1

$$\frac{\sqrt{a^6 b^5}}{\sqrt[3]{a^5 b^3}} = \frac{a^{\frac{6}{2}} b^{\frac{5}{2}}}{a^{\frac{5}{3}} b^{\frac{3}{3}}} = a^{\frac{4}{3}} b^{\frac{3}{2}}$$

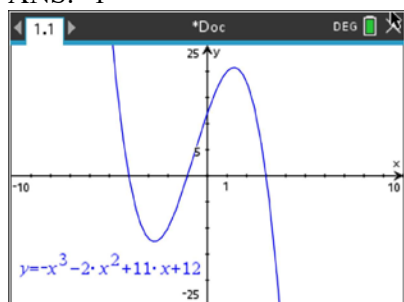
PTS: 2

REF: 082608aii

NAT: N.RN.A.2

TOP: Radicals and Rational Exponents

9 ANS: 1



PTS: 2

REF: 082609aai

NAT: F.IF.B.4

TOP: Graphing Polynomial Functions

10 ANS: 4

$$4x^{\frac{3}{2}} = 32$$

$$x^{\frac{3}{2}} = 8$$

$$x = 4$$

PTS: 2

REF: 082610aai

NAT: A.REI.A.2

TOP: Solving Radicals

11 ANS: 3

PTS: 2

REF: 082611aai

NAT: F.TF.A.2

TOP: Determining Trigonometric Functions

KEY: radians

12 ANS: 4

PTS: 2

REF: 082612ai

NAT: F.BF.A.1

TOP: Modeling Exponential Functions

13 ANS: 1

$$\frac{52}{250} = 0.208$$

PTS: 2

REF: 082613aai

NAT: S.CP.A.4

TOP: Conditional Probability

14 ANS: 1

PTS: 2

REF: 082614aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

15 ANS: 2

$$\text{If } \sin \theta = \frac{21}{29}, \cos \theta = -\frac{20}{29} \text{ in QII, and } \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\frac{21}{29}}{-\frac{20}{29}} = -\frac{21}{20}$$

PTS: 2

REF: 082615aai

NAT: F.TF.C.8

TOP: Determining Trigonometric Functions

16 ANS: 2

$$\frac{6(k+3)}{k(k+3)} + \frac{k(k+2)}{k(k+3)} = \frac{2}{k^2+3k}$$

$$6k + 18 + k^2 + 2k = 2$$

$$k^2 + 8k + 16 = 0$$

$$(k+4)^2 = 0$$

$$k = -4$$

PTS: 2

REF: 082616aai

NAT: A.REI.A.2

TOP: Solving Rationals

17 ANS: 3

$$.68 \times 500 = 340$$

PTS: 2

REF: 082617aai

NAT: S.ID.A.4

TOP: Normal Distributions

18 ANS: 4

PTS: 2

REF: 082618aai

NAT: S.IC.B.3

TOP: Analysis of Data

19 ANS: 1

$$1.59^{\frac{1}{3}} \approx 1.167$$

PTS: 2

REF: 082619aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

20 ANS: 1

$$\frac{x^2+7}{2} = -x$$

$$x^2 + 7 = -2x$$

$$x^2 + 2x = -7$$

$$x^2 + 2x + 1 = -7 + 1$$

$$(x+1)^2 = -6$$

$$x = -1 \pm i\sqrt{6}$$

PTS: 2

REF: 082620aai

NAT: A.REI.B.4

TOP: Solving Quadratics

21 ANS: 4

Let $u = x^3$:

$$u^2 - 63u - 64$$

$$(u-64)(u+1)$$

$$(x^3-64)(x^3+1)$$

$$(x-4)(x^2+4x+16)(x+1)(x^2-x+1)$$

PTS: 2

REF: 082621aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

22 ANS: 1

PTS: 2

REF: 082622aai

NAT: F.BF.B.3

TOP: Even and Odd Functions

KEY: graphically

23 ANS: 2

$$x = 2^{y+1}$$

$$\log_2 x = \log_2 2^{y+1}$$

$$\log_2 x = y + 1$$

$$\log_2 x - 1 = y$$

PTS: 2

REF: 082623aai

NAT: F.BF.B.5

TOP: Inverse of Functions

KEY: exponential

24 ANS: 2

$$-\frac{3a}{2}(-1) + \frac{a}{2} = \frac{3a}{2} + \frac{a}{2} = 2a; \quad b = \frac{2\pi}{4b} = \frac{\pi}{2b}$$

PTS: 2

REF: 082624aai

NAT: F.IF.C.7

TOP: Graphing Trigonometric Functions

KEY: mixed

25 ANS:

Observational study because the manager is not giving a treatment.

PTS: 2

REF: 082625aai

NAT: S.IC.B.3

TOP: Analysis of Data

26 ANS:

$$2x^2 + 3x - 7 - (2x - 5) = 2x^2 + x - 2$$

PTS: 2

REF: 082626aai

NAT: F.BF.A.1

TOP: Operations with Functions

27 ANS:

$$x^3 - 4x^2 - 9x + 36 = 0$$

$$x^2(x - 4) - 9(x - 4) = 0$$

$$(x^2 - 9)(x - 4) = 0$$

$$x = -3, 3, 4$$

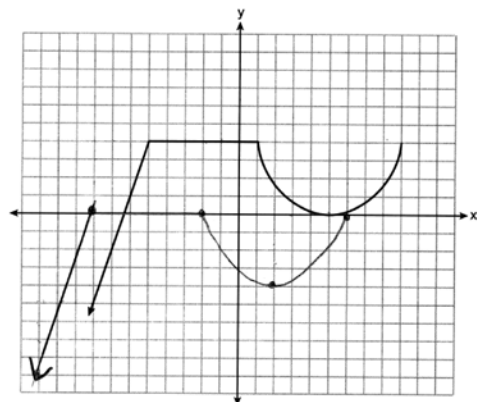
PTS: 2

REF: 082627aai

NAT: A.APR.B.3

TOP: Solving Polynomial Equations

28 ANS:



PTS: 2

REF: 082628aai

NAT: F.BF.B.3

TOP: Transformations with Functions

29 ANS:

$$(-2 + \sqrt{-25})^2 = (-2 + 5i)^2 = 4 - 20i + 25i^2 = 4 - 20i - 25 = -21 - 20i$$

PTS: 2

REF: 082629aai

NAT: N.CN.A.2

TOP: Square Roots of Negative Numbers

KEY: multiplication

30 ANS:

$$c(t) = 2.7(0.5)^{\frac{t}{30}}$$

PTS: 2

REF: 082630aai

NAT: F.BF.A.1

TOP: Modeling Exponential Functions

31 ANS:

$$(0-3) + (x-3) + (2x-3) + (3x-3) + (4x-3) = 5$$

$$10x - 15 = 5$$

$$10x = 20$$

$$x = 2$$

PTS: 2

REF: 082631aai

NAT: F.BF.B.6

TOP: Sigma Notation

KEY: arithmetic

32 ANS:

$$y = 5.381(1.239)^x$$

PTS: 2

REF: 082632aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

33 ANS:

$$\begin{array}{r} \overline{2x^2 - 6x + 1} \\ x^2 + 3x - 5 \overline{) 2x^4 + 0x^3 - 27x^2 + 33x - 8} \phantom{2x^2 - 6x + 1 - \frac{3}{x^2 + 3x - 5}} \\ \underline{2x^4 + 6x^3 - 10x^2} \\ -6x^3 - 17x^2 + 33x \\ \underline{-6x^3 - 18x^2 + 30x} \\ x^2 + 3x - 8 \\ \underline{x^2 + 3x - 5} \\ -3 \end{array}$$

PTS: 4

REF: 082633aai

NAT: A.APR.D.6

TOP: Rational Expressions

KEY: division

34 ANS:

$$2; \frac{4-2}{2} = \frac{6}{2} = 3; f(x) = 3 \sin \pi x + 1$$

PTS: 4

REF: 082634aai

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

35 ANS:

$0.652 \pm 2 \cdot 0.031 \approx 0.59 - 0.71$. No, since half falls outside the 95% interval.

PTS: 4

REF: 082635aaii

NAT: S.IC.A.2

TOP: Analysis of Data

36 ANS:

$110 + 74 = 184$; $\frac{T(5) - T(0)}{5 - 0} \approx -4.5$; From $x = 0$ to $x = 5$, the temperature of the tea decreases about 4.5° every minute. $120 = 110e^{-0.0453x} + 74$
 $x \approx 19.2$

PTS: 6

REF: 082636aaii

NAT: F.LE.A.4

TOP: Exponential Decay