

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

INTEGRATED ALGEBRA

Wednesday, June 1, 2016 — 1:15 to 4:15 p.m., only

Student Name: Steve Watson

School Name: JMAP.ORG

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

A separate answer sheet for Part I has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 39 questions. You must answer all questions in this examination. Record your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. All work should be written in pen, except graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice...

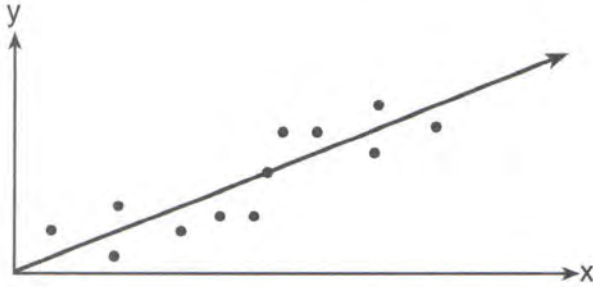
A graphing calculator and a straightedge (ruler) must be available for you to use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 30 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the separate answer sheet the numeral preceding the word or expression that best completes the statement or answers the question. [60]

- 1 A line of best fit has been drawn on the scatter plot below.



Use this space for computations.

The relationship between these variables can be described as having

- (1) a negative correlation (3) a positive correlation
(2) no correlation (4) zero correlation

- 2 The amount of money spent at a parking meter varies directly with the amount of time spent parked in the parking space. Noah spent \$1.50 to park 90 minutes. How many minutes can he park for \$4.00?

- (1) 667 (3) 240
(2) 360 (4) 135

goes through $(0,0) \rightarrow (0,0)$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{90 - 0}{1.50 - 0}$$

$$m = 60$$

\$	min
0	0
1.50	90
4.00	240

$y = mx + b$
 $y = 60x$

← y-intercept
← answer

- 3 An athlete has one blue jersey and one orange jersey, as well as 3 different colors of pants. He also has 2 different colors of helmets. How many distinct uniforms consisting of one helmet, one jersey, and one pair of pants does the athlete have?

- (1) 5 (3) 7
(2) 6 (4) 12

Helmet Choices Jersey Choices Pants Choices

$$[2] \times [2] \times [3] = 12$$

4 Given:

$$A = \{0, 1, 2, 3, 4\}$$

$$B = \{0, 2, 3, 5, 7\}$$

$$C = \{0, 2, 4, 6, 8\}$$

What is the intersection of sets A, B, and C?

(1) $\{0\}$

(3) $\{0, 2, 3, 4\}$

(2) $\{0, 2\}$

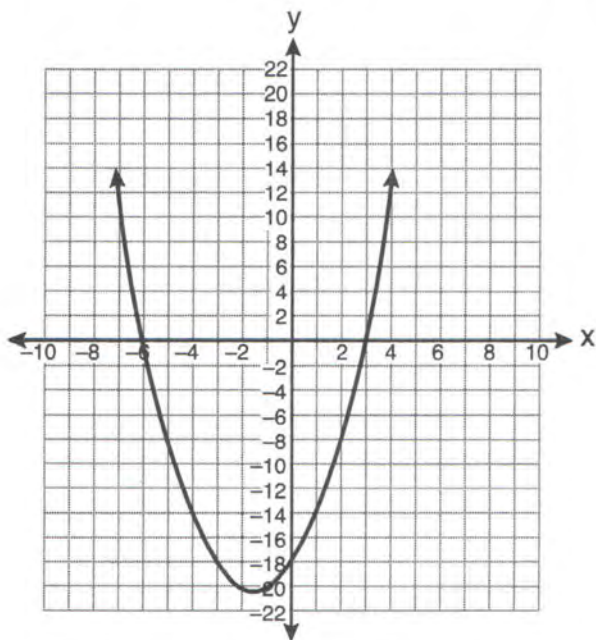
(4) $\{0, 1, 2, 3, 4, 5, 6, 7, 8\}$

Use this space for computations.

A	0	1	2	3	4	x	x	x	x
B	0	x	2	3	x	5	x	7	
C	0	x	2	x	4	x	6	x	8

intersections

5 The equation $y = x^2 + 3x - 18$ is graphed on the set of axes below.



The roots of an equation are the values of x when the graph crosses the x -axis. (The values of x when $y = 0$).

Based on this graph, what are the roots of the equation $x^2 + 3x - 18 = 0$?

(1) -3 and 6

(3) 3 and -6

(2) 0 and -18

(4) 3 and -18

6 What is an equation of the line that passes through $(-2, 3)$ and $(6, -1)$?

Use this space for computations.

(1) $y = -\frac{1}{2}x + 2$

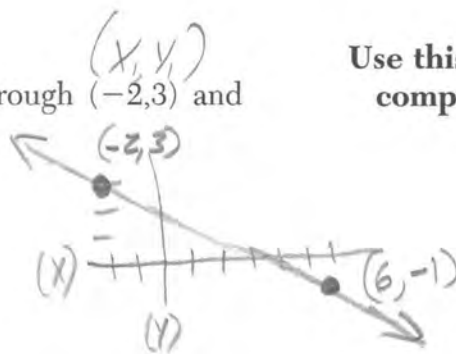
(2) $y = -\frac{1}{2}x + 4$

y-intercept must be less than 3

(3) $y = 2x + 7$

(4) $y = 2x - 1$

positive slope



Check in graphing calculator
 $y = -\frac{1}{2}x + 2$

X	Y
-2	3 ✓
0	2
2	1
4	0
6	-1 ✓

7 If each member of the data set $\{2, 2, 3, 5, 8\}$ is multiplied by 2, which changes will take place in the mean, median, and mode of the data?

(1) The mean, median, and mode will be multiplied by 2.

(2) The median will remain the same; the mean and mode will be multiplied by 2.

(3) The mode will remain the same; the mean and median will be multiplied by 2.

(4) The mean will remain the same; the median and mode will be multiplied by 2.

	Mean	Median	Mode
$\{2, 2, 3, 5, 8\}$	4	3	2
$\{4, 4, 6, 10, 16\}$	8	6	4

8 Which characteristic of a cat is qualitative?

(1) age # of years

(3) length # of inches

(2) color

(4) weight # of pounds

not numerical
not a number

9 What is the value of A in the following system of equations?

$$\begin{cases} 3(2A + 3W = 12) \\ 1(6A - 5W = 8) \end{cases}$$

(1) 1

(2) 2

(3) 3

(4) 9

$$\Rightarrow \begin{cases} 6A + 9W = 36 \\ 6A - 5W = 8 \end{cases}$$

$14W = 28$

$W = 2$

substitute

Subtract

$2A + 3(2) = 12$

$2A + 6 = 12$

$2A = 6$

$A = 3$

Use this space for
computations.

10 A cell phone company is conducting a survey to determine the cell phone features that its customers use. Which survey is least biased?

- (1) The company conducts the survey on teenagers.
- (2) The company conducts the survey on all age groups.
- (3) The company conducts the survey on retired females.
- (4) The company conducts the survey on middle-aged males.

11 Which pair of linear equations represents parallel lines?

(1) $y = -\frac{1}{2}x + 4$
 $y = 2x + 4$

(3) $y = 5x + 1$
 $y = -5x + 7$

(2) $x + y = 5 \Rightarrow y = -x + 5$
 $-x + y = 4 \Rightarrow y = x + 4$

(4) $2x + y = 4 \Rightarrow y = -2x + 4$
 $y + 2x = 8 \Rightarrow y = -2x + 8$

parallel lines have
same slopes and
different y-intercepts.

Choices 1, 2, and 3 have
different slopes, so
they cannot be parallel.

Same slopes
Different y-intercepts

12 Which set of points does not represent a function?

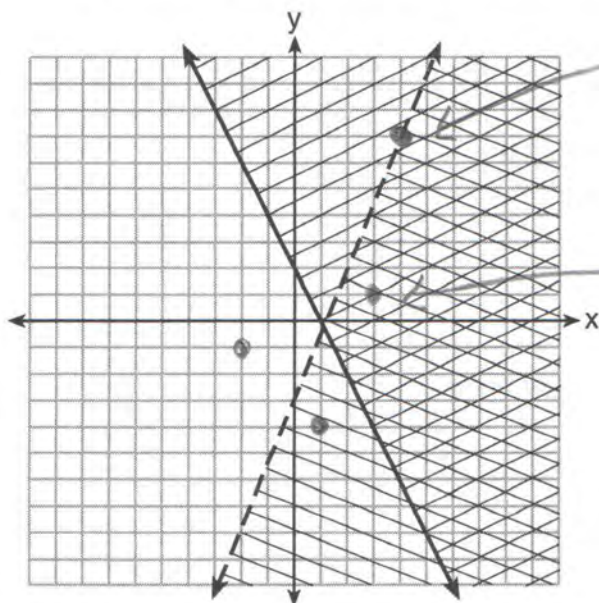
- (1) $\{(-3, -2), (-1, -2), (0, -1), (1, 0)\}$
- (2) $\{(-2, 3), (0, 4), (3, -2), (4, 2)\}$
- (3) $\{(2, -2), (1, 4), (2, 5), (3, 6)\}$
- (4) $\{(-2, 4), (1, 1), (2, 4), (3, 9)\}$

A function has one,
and only one,
value of y for every
value of x .

In choice 3, when $x = 2$,
there is more than one
value of y . Therefore,
choice 3 cannot be a
function.

13 A system of inequalities is graphed on the set of axes below.

Use this space for computations.



$(4, 7)$ lies on a dotted line, so it is not a solution

$(3, 1)$ solves both inequalities

The coordinates of a point in the solution of this system of inequalities are

(1) $(4, 7)$

(3) $(-2, -1)$

(2) $(1, -4)$

(4) $(3, 1)$

14 The axis of symmetry and the vertex of $y = x^2 - 4x + 10$ are

(1) $x = 2$ and $(2, 6)$

(3) $y = -2$ and $(-2, 6)$

(2) $y = 2$ and $(2, 6)$

(4) $x = -2$ and $(-2, 6)$

$a=1$ $b=-4$ $c=10$ axis of symmetry $= \frac{-b}{2a} = \frac{-(-4)}{2(1)} = \frac{4}{2} = 2$

axis of symmetry $x = 2$
check in graphing calculator

Note: Eliminate any choices where the equation of the axis of symmetry does not begin with x equals

15 What is the slope of the line whose equation is $4x = 3(y + 8)$?

(1) $\frac{4}{3}$

(3) $-\frac{4}{3}$

(2) $\frac{3}{4}$

(4) $-\frac{3}{4}$

$4x = 3(y + 8)$

$4x = 3y + 24$

$4x - 24 = 3y$

$\frac{4}{3}x - \frac{24}{3} = y$

$y = mx + b$
slope

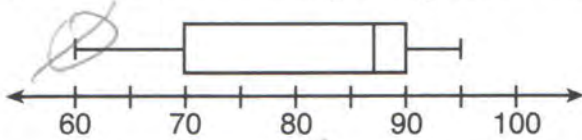
$y = \frac{4}{3}x - 8$
slope

x	y
0	10
1	7
2	6
3	7
4	10

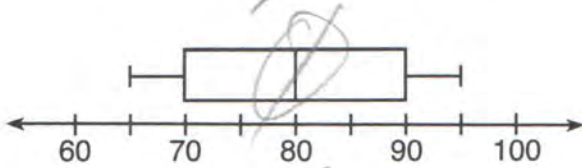
Use this space for
computations.

- 16 The students in Ms. Glenn's math class earned the grades shown below. *Min* *Q₁* *Q₂* *Q₃* *Max*
65, 70, 70, 80, 80, 82, 88, 88, 90, 90, 95

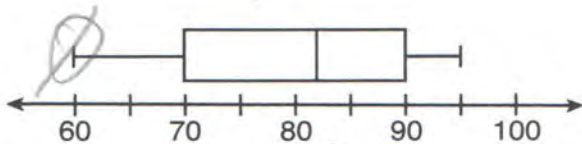
Which box-and-whisker plot represents these data?



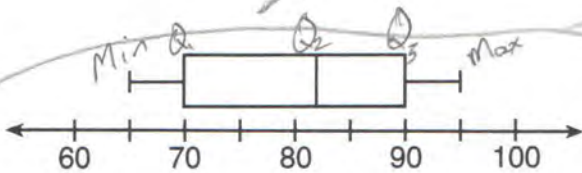
(1)



(2)



(3)



(4)

- 17 When translated into symbols, "three less than half of a number" is

(1) $3 - \frac{1}{2}x$

(3) $3 < \frac{1}{2}x$

(2) $\frac{1}{2}x - 3$

(4) $\frac{1}{2}x < 3$

$-3 + \frac{1}{2}x$
 $\frac{1}{2}x - 3$

- 18 An example of an algebraic expression is

(1) $6x - 2 \geq 4$

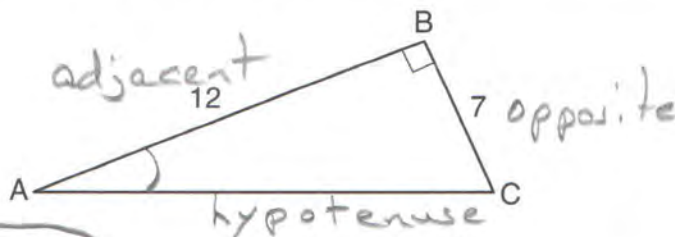
(3) $(x - 4)(x - 1) = 6$

(2) $3x + 2y < -10$

(4) $3x^2 - 10x - 3$

Expressions do not
have equal signs
or inequality signs.

19 Which equation could be used to find the measure of one acute angle in the right triangle shown below?



(1) $\tan A = \frac{7}{12}$

(2) $\tan A = \frac{12}{7}$

(3) $\sin C = \frac{12}{7}$

(4) $\cos A = \frac{7}{12}$

Step 2.

$\tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{7}{12}$

Use this space for computations.

$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$

$\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$

$\tan = \frac{\text{opposite}}{\text{adjacent}}$

Step 1.

The hypotenuse is not given, so eliminate choices (3) and (4).

20 Which interval notation describes the set $S = \{x | -5 < x \leq 6\}$?

(1) $[-5, 6]$

(2) $(-5, 6]$

(3) $[-5, 6)$

(4) $(-5, 6)$

the negative five is not included $-5 < x \leq 6$ the six is included $6]$

Rules
• Curved parentheses do not include the #.

• Square cornered parentheses do include the #.

21 Robert invests \$800 in an account at 1.8% interest compounded annually. He will make no deposits or withdrawals on this account for 3 years. Which formula could be used to find the balance, A, in the account after the 3 years?

(1) $A = 800(1 - .018)^3$

(2) $A = 800(1 + .18)^3$

(3) $A = 800(1 - .018)^3$

(4) $A = 800(1 + .018)^3$

Exponential Growth

$A = P(1 + r)^t$

$P = 800$

$r = 1.8\% = .018$

$t = 3$

$A = 800(1 + .018)^3$

22 Which value of x is a solution of $-5x - 3 > -2x + 6$?

(1) -4

(2) -3

(3) 3

(4) 0

Step 1 Solve

$-5x - 3 > -2x + 6$

$-5x + 2x - 3 > 6$

$-3x - 3 > 6$

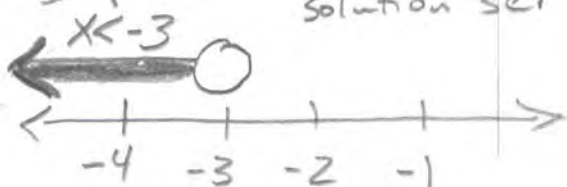
$-3x > 6 + 3$

$-3x > 9$

$\frac{-3x}{-3} < \frac{9}{-3}$

$x < -3$

Step 2 - Graph the solution set



23 Given $W = \frac{V^2 t}{R}$, which expression can be used to represent t in terms of W , R , and V ?

(1) $\frac{WR}{V^2}$

(3) $\frac{W}{R} - V^2$

(2) $\frac{W}{RV^2}$

(4) $WR - V^2$

Use this space for computations.

$$W = \frac{V^2 t}{R}$$

$$RW = V^2 t$$

$$\frac{RW}{V^2} = t$$

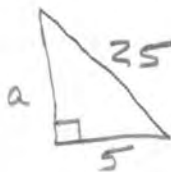
24 The longest side of a right triangle is 25. If one of the other sides is 5, which measure is the length of the missing side?

(1) $5\sqrt{26}$

(3) 30

(2) $10\sqrt{6}$

(4) 60



$$a^2 + b^2 = c^2$$

$$a^2 + 5^2 = 25^2$$

$$a^2 + 25 = 625$$

$$a^2 = 600$$

$$a = \sqrt{600}$$

$$a = \sqrt{100} \sqrt{6}$$

$$a = 10\sqrt{6}$$

25 Which statement is correct?

(1) $(2b^3c^5)(-3b^2c) = -6b^5c^5$

(2) $\frac{6m^3t^8}{-2m^5t^3} = \frac{-3t^5}{m^2}$

(3) $(-5n^4q)^2 = 25n^6q^2$

(4) $\frac{t^3}{v^5} \div \frac{v}{t} = \frac{t^2}{v^2}$

$$\frac{t^3}{v^5} \times \frac{t}{v} = \frac{t^4}{v^6}$$

26 What value of x would make the expression $\frac{x}{2x+1}$ undefined?

(1) 0

(3) -1

(2) $-\frac{1}{2}$

(4) $\frac{1}{2}$

→ A rational expression is undefined when the denominator = zero.

$$2x + 1 = 0$$

$$2x = -1$$

$$x = -\frac{1}{2}$$

Difference of Perfect Squares

27 Written in factored form, the binomial $a^2 - 16b^2$ is equivalent to

(1) $(a - 4b)(a + 4b)$

(3) $(a - 8b)(a + 8b)$

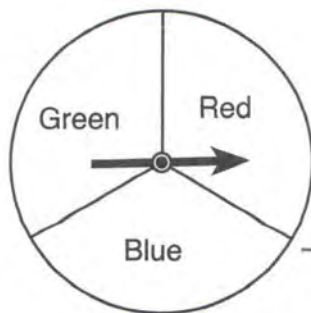
(2) $(a - 4b)(a - 4b)$

(4) $(a - 8b)(a - 8b)$

$$a^2 - b^2 = (a + b)(a - b)$$

$$a^2 - 16b^2 = (a + 4b)(a - 4b)$$

- 28 A spinner is divided into three equal regions, as shown in the diagram below. Ray spun the spinner six times and recorded his results: red, blue, blue, green, red, red.



Red
Blue
Green

Use this space for computations.

Theoretical Probability	Empirical Probability
$\frac{2}{6}$	$\frac{3}{6}$
$\frac{2}{6}$	$\frac{2}{6}$
$\frac{2}{6}$	$\frac{1}{6}$

Which statement is true about the outcomes of blue in Ray's experiment?

- (1) The empirical probability was less than the theoretical probability.
 (2) The empirical probability was greater than the theoretical probability.
 (3) The empirical and theoretical probabilities were equal.
 (4) The empirical and theoretical probabilities were unrelated.

- 29 Liam is 6 feet 2 inches, Eli is 5 feet 9 inches, Faith is 6 feet, and Simon is 5 feet 4 inches. In yards, what is the total of their heights?

- (1) $7\frac{3}{4}$
 (2) $7\frac{16}{36}$
 (3) $22\frac{15}{36}$
 (4) $23\frac{1}{4}$

	Feet	Inches
Liam	6	2
Eli	5	9
Faith	6	0
Simon	5	4
Total	22ft.	15in.
	23ft	3in.
	7yds	2ft 3in.
	7yds	0ft 27in.
	$7\frac{27}{36}$ yds	0ft 0in
	$7\frac{3}{4}$ yds	Simplify

- 30 The sum of $\frac{x}{2a}$ and $\frac{2x}{3a}$ is

- (1) $\frac{3x}{5a}$
 (2) $\frac{3x}{6a}$
 (3) $\frac{7x}{6a}$
 (4) $\frac{2x^2}{6a^2}$

Part II

Answer all 3 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

- 31 Jim calculated the area of a triangle to be 51.75 cm². The actual area of the triangle is 53.24 cm². Find the relative error in Jim's calculation of the area to the nearest thousandth.

$$\begin{aligned}
 \text{Relative Error} &= \left| \frac{\text{actual} - \text{measured}}{\text{actual}} \right| \\
 &= \left| \frac{51.75 - 53.24}{53.24} \right| \\
 &= \left| \frac{-1.49}{53.24} \right| \\
 &= .0279864763
 \end{aligned}$$

thousandths
hundredths
tenths

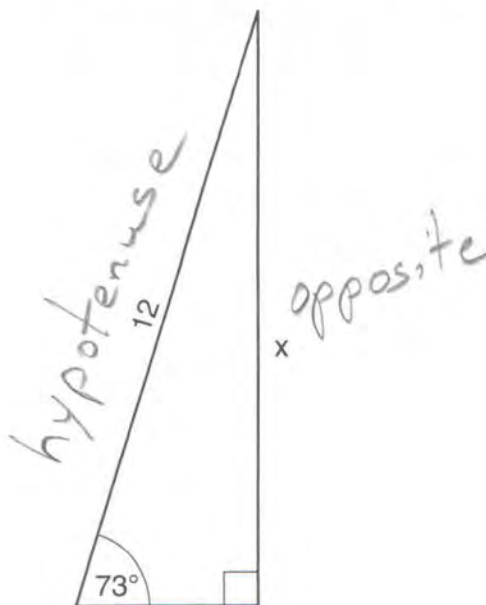
Answer

.028

- 32 A 12 foot ladder is placed against a wall. The ladder makes an angle of 73° with the floor. Determine, to the nearest tenth of a foot, how high up the wall the ladder will reach.

SOH
CAH
TOA

$$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$$



$$\sin 73^\circ = \frac{x}{12}$$

$$12(\sin 73^\circ) = x$$

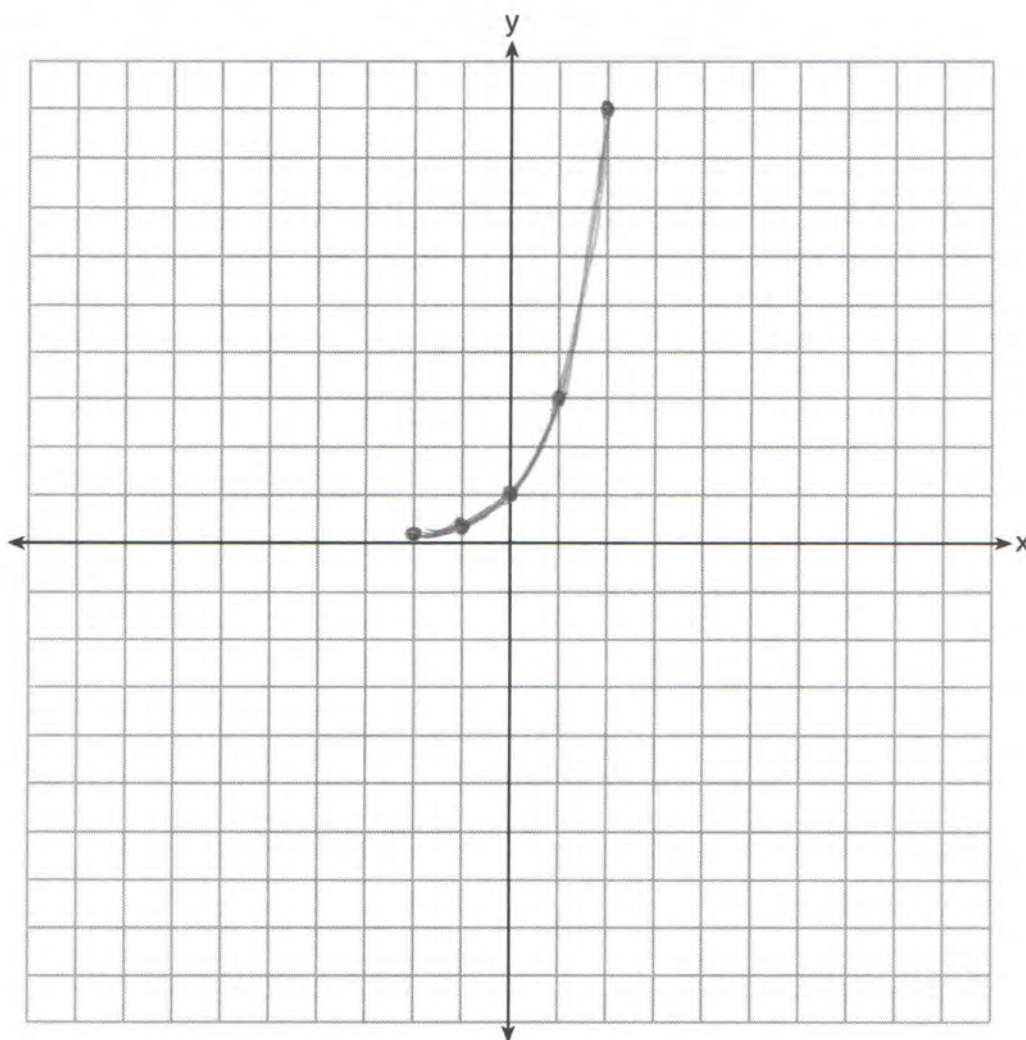
$$11.47565707 = x$$

tenths
hundredths

nearest tenth

11.5 feet answer

33 On the set of axes below, draw the graph of the function $y = 3^x$. Include the interval $-2 \leq x \leq 2$.



Step 1 Put $y = 3^x$ in graphing calculator

Step 2 Inspect graph and copy table of values for interval $-2 \leq x \leq 2$.

x	y
-2	.1111
-1	.3333
0	1
1	3
2	9

Step 3
Plot the graph

Part III

Answer all 3 questions in this part. Each correct answer will receive 3 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [9]

- 34 Ryan bought three bags of mixed tulip bulbs at a local garden store. The first bag contained 7 yellow bulbs, 8 red bulbs, and 5 white bulbs. The second bag contained 3 yellow bulbs, 11 red bulbs, and 6 white bulbs. The third bag contained 13 yellow bulbs, 2 red bulbs, and 5 white bulbs. Ryan combined the contents of these three bags into a single container. He randomly selected one bulb, planted it, and then randomly selected another and planted that one. Determine if it is more likely that Ryan planted a red bulb and then another red bulb, or planted a yellow bulb and then a white bulb. Justify your answer.

	Yellow	Red	White	Totals
Bag 1	7	8	5	20
Bag 2	3	11	6	20
Bag 3	13	2	5	20
Totals	23	21	16	60

$$P(a+b) = P(a) \cdot P(b)$$

$$P(\text{red+red}) = \left(\frac{21}{60}\right)\left(\frac{20}{59}\right) = \frac{420}{(60)(59)}$$

Bigger Numerator
Same Denominator

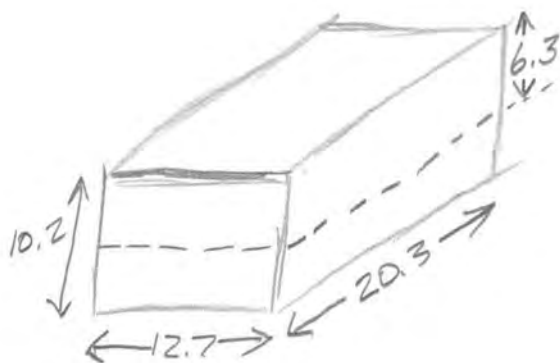
$$P(\text{yellow+white}) = \left(\frac{23}{60}\right)\left(\frac{16}{59}\right) = \frac{368}{(60)(59)}$$

Smaller Numerator
Same Denominator

Answer

Red followed by red is more likely.

- 35 A particular jewelry box is in the shape of a rectangular prism. The box is advertised as having an interior length of 20.3 centimeters, an interior width of 12.7 centimeters, and an interior height of 10.2 centimeters. However, when a customer measures the interior of the box, she finds that the interior height is actually 6.3 centimeters. Upon further examination, she discovers that the bottom of the interior of the box lifts up to reveal a hidden compartment. Find the volume of this hidden compartment to the nearest cubic centimeter.



Note
Assume that the top of the hidden compartment has zero thickness.

$$V = lwh$$

$$V = (20.3)(12.7)(10.2 - 6.3)$$

$$V = (20.3)(12.7)(3.9)$$

$$V = 1005.459$$

nearest cubic centimeter

$$V = \boxed{1005}$$

answer

36 Solve algebraically for all values of x that satisfy the equation: $\frac{x}{x+4} = \frac{3}{x+2}$

① cross multiply $\frac{x}{x+4} = \frac{3}{x+2}$

② use Distributive Property $x(x+2) = 3(x+4)$

③ Gather terms in left expression $x^2 + 2x = 3x + 12$

④ Simplify $x^2 + 2x - 3x - 12 = 0$

⑤ Factor $x^2 - x - 12 = 0$

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

⑥ Multiplication Property of zero

$x-4=0$

$x+3=0$

$x=4$

$x=-3$

⑦ answers

Check

$x=4$

$\frac{4}{4+4} = \frac{3}{4+2}$

$\frac{4}{8} = \frac{3}{6}$

$\frac{1}{2} = \frac{1}{2} \checkmark$

$x=-3$

$\frac{-3}{-3+4} = \frac{3}{-3+2}$

$\frac{-3}{1} = \frac{3}{-1}$

$-3 = -3 \checkmark$

Part IV

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

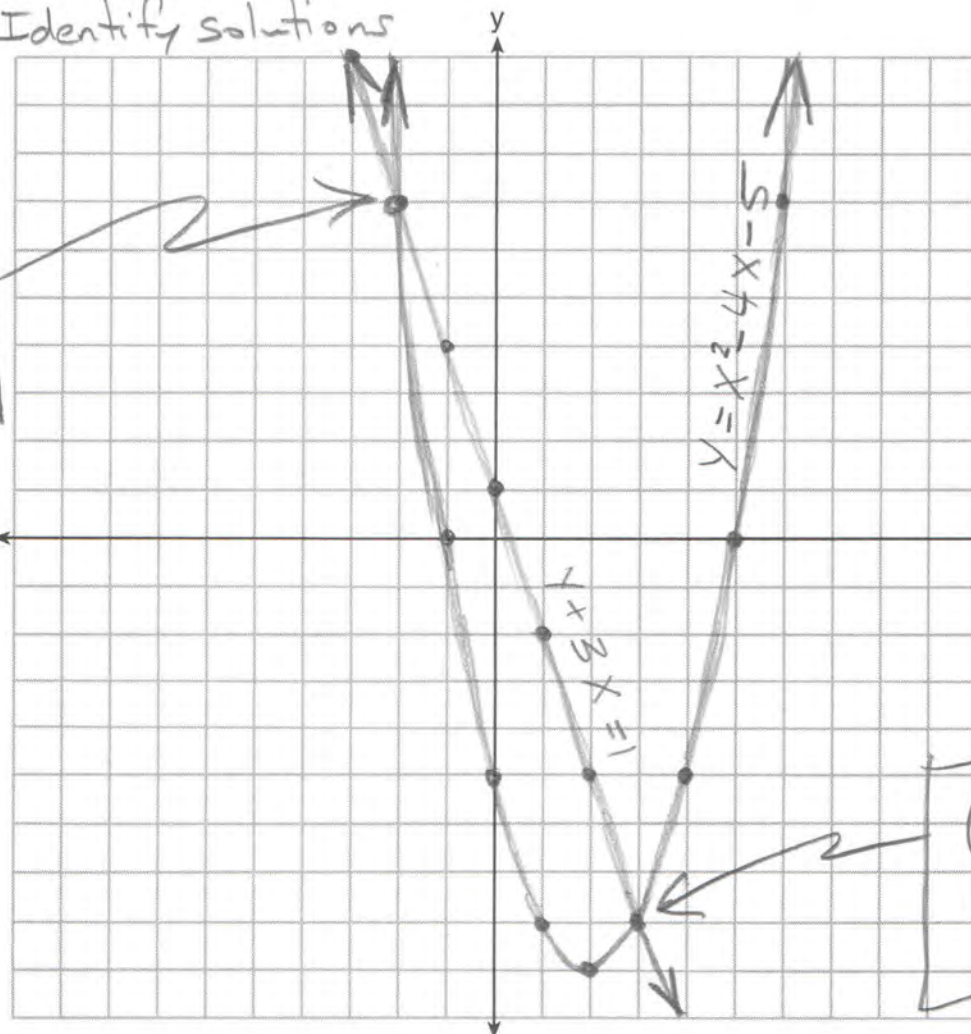
37 On the set of axes below, solve the following system of equations graphically for all values of x and y . State the coordinates of all solutions.

Step 1 - Put both equations in graphing calculator
 $y = x^2 - 4x - 5$
 $y + 3x = 1 \Rightarrow y = -3x + 1$

Step 2 - Inspect graph and copy table of values

Step 3 - Plot graphs

Step 4 - Identify solutions



x	y_1	y_2
-2	7	7
-1	0	4
0	-5	1
1	-8	-2
2	-9	-5
3	-8	-8
4	-5	-1
5	0	
6	7	

38 Express in simplest form: $\frac{x^2 + 5x + 6}{x^2 - x - 20} \div \frac{x^2 + x - 6}{2x - 10}$ → division

Step 1
Change to a
multiplication
problem

$$\frac{x^2 + 5x + 6}{x^2 - x - 20}$$

→ multiplication

$$\times \frac{2x - 10}{x^2 + x - 16} \quad \left. \vphantom{\frac{2x - 10}{x^2 + x - 16}} \right\} \text{inverted}$$

Step 2
Factor everything
and cancel.

$$\frac{[(x+3)(x+2)] [(2)(x-5)]}{[(x-5)(x+4)] [(x+3)(x-2)]}$$

Step 3
Simplify
what is
left.

$$\frac{(x+2)(2)}{(x+4)(x-2)}$$

$$\frac{2x+4}{x^2+2x-8}$$

answer

39 The length of a rectangle is $(3\sqrt{8} + 2)$ and the width is $(2\sqrt{2} + 1)$.

Express the perimeter of the rectangle in simplest radical form.

$$P = 2(l + w)$$

$$P = 2(3\sqrt{8} + 2 + 2\sqrt{2} + 1)$$

$$P = 2(3\sqrt{4\sqrt{2}} + 2 + 2\sqrt{2} + 1)$$

$$P = 2(3 \cdot 2\sqrt{2} + 2 + 2\sqrt{2} + 1)$$

$$P = 2(6\sqrt{2} + 2\sqrt{2} + 2 + 1)$$

$$P = 2(8\sqrt{2} + 3)$$

$$P = \boxed{16\sqrt{2} + 6} \text{ answer}$$

Express the area of the rectangle in simplest radical form.

$$A = lw$$

$$A = (3\sqrt{8} + 2)(2\sqrt{2} + 1)$$

$$A = (3\sqrt{8} \cdot 2\sqrt{2}) + (3\sqrt{8} \cdot 1) + (2 \cdot 2\sqrt{2}) + (2 \cdot 1)$$

$$A = (6\sqrt{16}) + (3\sqrt{8}) + (4\sqrt{2}) + (2)$$

$$A = (6 \cdot 4) + (3\sqrt{4\sqrt{2}}) + (4\sqrt{2}) + (2)$$

$$A = 24 + (3 \cdot 2\sqrt{2}) + (4\sqrt{2}) + (2)$$

$$A = 24 + 6\sqrt{2} + 4\sqrt{2} + 2$$

$$A = \boxed{26 + 10\sqrt{2}} \text{ answer}$$