The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I (Common Core)

Monday, January 26, 2015 — 1:15 to 4:15 p.m., only

Student Name: _Steve Watson_

School Name: _www.jmap.org_

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 37 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 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

Use this space for computations.

1 The owner of a small computer repair business has one employee, who is paid an hourly rate of $22. The owner estimates his weekly profit using the function $P(x) = 8600 - 22x$. In this function, x represents the number of

(1) computers repaired per week

● hours worked per week

(3) customers served per week

(4) days worked per week

Weekly Profit = Revenues − Expenses

Weekly Profit = $8600 − $22 (hours per week)

2 Peyton is a sprinter who can run the 40-yard dash in 4.5 seconds. He converts his speed into miles per hour, as shown below.

$$\frac{40 \text{ yd}}{4.5 \text{ sec}} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}}$$

Which ratio is *incorrectly* written to convert his speed?

(1) $\dfrac{3 \text{ ft}}{1 \text{ yd}}$ (3) $\dfrac{60 \text{ sec}}{1 \text{ min}}$

● $\dfrac{5280 \text{ ft}}{1 \text{ mi}}$ (4) $\dfrac{60 \text{ min}}{1 \text{ hr}}$

↳ should be $\dfrac{1 \text{ mile}}{5,280 \text{ ft}}$

3 Which equation has the same solutions as $2x^2 + x - 3 = 0$?

$2x^2 + 6x - x - 3$

(1) $(2x - 1)(x + 3) = 0$ (3) $(2x - 3)(x + 1) = 0$ *$2x^2 + 2x - 3x - 3$*

(2) $(2x + 1)(x - 3) = 0$ ● $(2x + 3)(x - 1) = 0$

$2x^2 - 6x + x - 3$ *$2x^2 - 2x + 3x - 3$*

Factor by Grouping

$2x^2 + x - 3 = 0$

$ac = -6$

sums to +1

-1 6   1 -6
*   2 -3*

$(2+3)$

$(2x^2 - 2x) + (3x - 3) = 0$

$2x(x-1) + 3(x-1) = 0$

$(2x+3)(x-1) = 0$

Algebra I (Common Core) – Jan. '15   [2]

4 Krystal was given $3000 when she turned 2 years old. Her parents invested it at a 2% interest rate compounded annually. No deposits or withdrawals were made. Which expression can be used to determine how much money Krystal had in the account when she turned 18?

● $3000(1 + 0.02)^{16}$ (3) $3000(1 + 0.02)^{18}$

(2) $3000(1 - 0.02)^{16}$ (4) $3000(1 - 0.02)^{18}$

[handwritten: → 18 - 2 = 16 The interest is compounded 16 times]

5 Which table of values represent a linear relationship?

x	f(x)
-1	-3
0	-2
1	1
2	6
3	13

(1)

[handwritten: 1 3 5 7]

x	f(x)
-1	-3
0	-1
1	1
2	3
3	5

●

[handwritten: 2 2 2 2]

[handwritten: Constant ratio of 2/1]

x	f(x)
-1	$\frac{1}{2}$
0	1
1	2
2	4
3	8

(2)

[handwritten: ½ 1 2 4]

x	f(x)
-1	-1
0	0
1	1
2	8
3	27

(4)

[handwritten: 1 1 7 19]

6 Which domain would be the most appropriate set to use for a function that predicts the number of household online-devices in terms of the number of people in the household?

(1) integers   (3) irrational numbers *[handwritten: → We don't need irrationals]*

● whole numbers   (4) rational numbers

[handwritten: We don't need fractions]

[handwritten: → we don't need negative #s]

[handwritten graph labels: # Household Online Devices / # people in Household]

7 The inequality $7 - \frac{2}{3}x < x - 8$ is equivalent to

(1) $x > 9$ ⬤

(2) $x > -\frac{3}{5}$

(3) $x < 9$

(4) $x < -\frac{3}{5}$

Handwritten work:

$7 - \frac{2}{3}x < x - 8$

$21 - 2x < 3x - 24$

$24 \quad +2x \qquad +2x + 24$

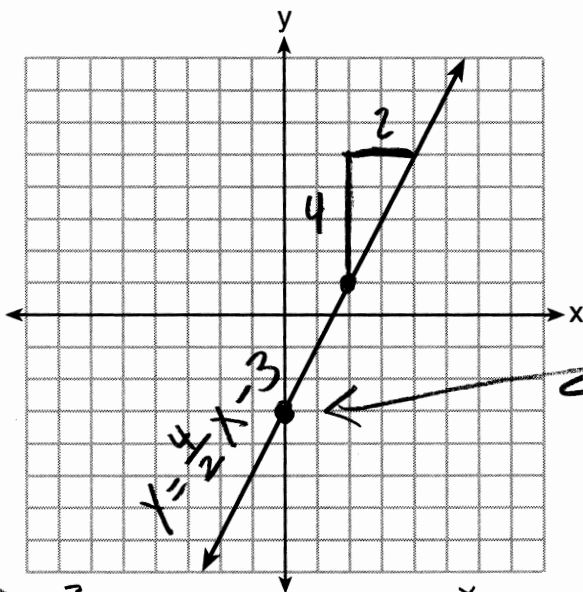$45 \qquad < 5x$

$\frac{45}{5} \qquad < x$

$\boxed{9 < x}$

8 The value in dollars, $v(x)$, of a certain car after x years is represented by the equation $v(x) = 25{,}000(0.86)^x$. To the *nearest dollar*, how much more is the car worth after 2 years than after 3 years?

(1) 2589 ⬤

(2) 6510

(3) 15,901

(4) 18,490

Handwritten work:

$V(2) = 25{,}000(0.86)^2$

$V_{(2)} = 18{,}490$

$V_{(3)} = 25{,}000(0.86)^3$

$V_{(3)} = 15{,}901$

$V_{(2)} - V_{(3)} = 18{,}490 - 15{,}901 = \boxed{2589}$

9 Which function has the same y-intercept as the graph below?

Handwritten on graph: $y = \frac{x}{2} - 3$, $y\text{-intercept} = -3$

$y = 3 - \frac{3}{2}x$

(1) $y = \frac{12 - 6x}{4}$

(2) $27 + 3y = 6x$

$y = \frac{-x}{6} + 3$

(3) $6y + x = 18$

(4) $y + 3 = 6x$ ⬤

Handwritten work:

$3y = 6x - 27$

$y = 2x - 9$

$y = 6x - 3 \quad \leftarrow y\text{-intercept} = -3$

10 Fred is given a rectangular piece of paper. If the length of Fred's piece of paper is represented by $2x - 6$ and the width is represented by $3x - 5$, then the paper has a total area represented by

(1) $5x - 11$ (3) $10x - 22$

● $6x^2 - 28x + 30$ (4) $6x^2 - 6x - 11$

11 The graph of a linear equation contains the points $(3,11)$ and $(-2,1)$. Which point also lies on the graph?

(1) $(2,1)$ (3) $(2,6)$

(2) $(2,4)$ ● $(2,9)$

12 How does the graph of $f(x) = 3(x - 2)^2 + 1$ compare to the graph of $g(x) = x^2$?

(1) The graph of $f(x)$ is wider than the graph of $g(x)$, and its vertex is moved to the left 2 units and up 1 unit.

● The graph of $f(x)$ is narrower than the graph of $g(x)$, and its vertex is moved to the right 2 units and up 1 unit.

(3) The graph of $f(x)$ is narrower than the graph of $g(x)$, and its vertex is moved to the left 2 units and up 1 unit.

(4) The graph of $f(x)$ is wider than the graph of $g(x)$, and its vertex is moved to the right 2 units and up 1 unit.

13 Connor wants to attend the town carnival. The price of admission to the carnival is \$4.50, and each ride costs an additional 79 cents. If he can spend at most \$16.00 at the carnival, which inequality can be used to solve for r, the number of rides Connor can go on, and what is the maximum number of rides he can go on?

(1) $0.79 + 4.50r \le 16.00$; 3 rides

(2) $0.79 + 4.50r \le 16.00$; 4 rides

● $4.50 + 0.79r \le 16.00$; 14 rides
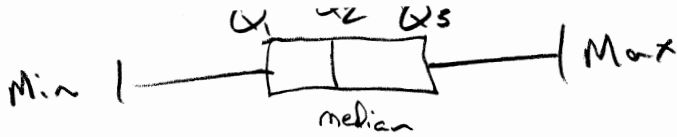
(4) $4.50 + 0.79r \le 16.00$; 15 rides

$$\left(2x-6\right)\left(3x-5\right)$$
$$6x^2 - 10x - 18x + 30$$
$$6x^2 - 28x + 30$$
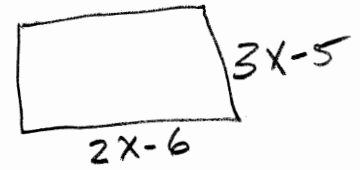
$$m = \frac{1-11}{-2-3} = \frac{-10}{-5} = 2$$

$$y = 2x + b$$
$$11 = 2(3) + b$$
$$11 = 6 + b$$
$$5 = b$$
$$y = 2x + 5$$

Hint

Plug both equations into graphing calculator

$$4.50 + .79(\#\ rides) \le 16$$

$$4.5 + .79r \le 16$$
$$-4.5 \qquad -4.5$$
$$.79r \le 11.5$$
$$r \le \frac{11.5}{.79}$$
$$r \le 14.5569$$

(handwritten at top) Min |——————[⌐⌐⌐]———————| Max
with labels Q₁, Q₂, Q₃ above box, "median" below

14 Corinne is planning a beach vacation in July and is analyzing the daily high temperatures for her potential destination. She would like to choose a destination with a high median temperature and a small interquartile range. She constructed box plots shown in the diagram below.

Use this space for computations.

(handwritten annotations: X Q2<80, Ocean Beach; Serene Shores X Q2<80; √Q2>80 Whispering Palms "Big interquartile"; Pelican Beach √Q2>80 "Small interquartile")

Ocean Beach

Serene Shores

Whispering Palms

Pelican Beach

70 75 80 85 90 95 100   70 75 80 85 90 95 100
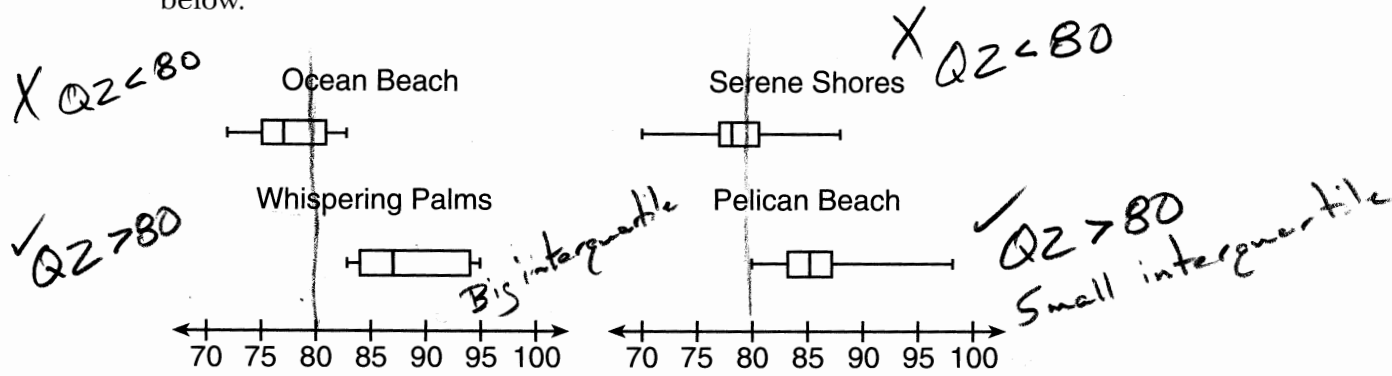
Which destination has a median temperature above 80 degrees and the smallest interquartile range?

(1) Ocean Beach   (3) Serene Shores

(2) Whispering Palms   (●) Pelican Beach

15 Some banks charge a fee on savings accounts that are left inactive for an extended period of time. The equation $y = 5000(0.98)^x$ represents the value, y, of one account that was left inactive for a period of x years.

What is the y-intercept of this equation and what does it represent?

(1) 0.98, the percent of money in the account initially

(2) 0.98, the percent of money in the account after x years

(●) 5000, the amount of money in the account initially

(4) 5000, the amount of money in the account after x years

(handwritten)
$$y_{(0)} = 5000(0.98)^0$$
$$y_{(0)} = 5000(1)$$
$$y_{(0)} = 5000$$

16 The equation for the volume of a cylinder is $V = \pi r^2 h$. The positive value of r, in terms of h and V, is

● $r = \sqrt{\dfrac{V}{\pi h}}$

(2) $r = \sqrt{V \pi h}$

(3) $r = 2V\pi h$

(4) $r = \dfrac{V}{2\pi}$

Handwritten:
$$V = \pi r^2 h$$
$$\frac{V}{\pi h} = r^2$$
$$\sqrt{\frac{V}{\pi h}} = r$$

17 Which equation has the same solutions as $x^2 + 6x - 7 = 0$?

(1) $(x + 3)^2 = 2$

(2) $(x - 3)^2 = 2$

(3) $(x - 3)^2 = 16$

● $(x + 3)^2 = 16$

Handwritten:
Complete the Square
$$x^2 + 6x = 7$$
$$\left(x + \frac{6}{2}\right)^2 = 7 + \left(\frac{6}{2}\right)^2$$
$$(x+3)^2 = 7 + 9$$
$$(x+3)^2 = 16$$

18 Two functions, $y = |x - 3|$ and $3x + 3y = 27$, are graphed on the same set of axes. Which statement is true about the solution to the system of equations?

(1) $(3,0)$ is the solution to the system because it satisfies the equation $y = |x - 3|$.

(2) $(9,0)$ is the solution to the system because it satisfies the equation $3x + 3y = 27$.

● $(6,3)$ is the solution to the system because it satisfies both equations.

(4) $(3,0)$, $(9,0)$, and $(6,3)$ are the solutions to the system of equations because they all satisfy at least one of the equations.

Handwritten:
$$y = |x - 3|$$
$$3y = -3x + 27$$
$$y = -x + 9$$

X	Y₁	Y₂
0	3	9
1	2	8
2	1	7
3	0	6
4	1	5
5	2	4
6	3	3

19 Miriam and Jessica are growing bacteria in a laboratory. Miriam uses the growth function $f(t) = n^{2t}$ while Jessica uses the function $g(t) = n^{4t}$, where n represents the initial number of bacteria and t is the time, in hours. If Miriam starts with 16 bacteria, how many bacteria should Jessica start with to achieve the same growth over time?

(1) 32   (3) 8

(2) 16   ● 4

$$n^{2t} = n^{4t} \qquad 16 = n^2$$
$$n^{2t} = (n^2)^{2t} \qquad \sqrt{16} = n$$
$$\boxed{4 = n}$$

Use this space for computations.

Check

x	y
0	1
1	256
2	65,536

$y = 16^{(2x)}$

Check

$y = 4^{(4x)}$

X	Y
0	1
1	256
2	65,536

20 If a sequence is defined recursively by $f(0) = 2$ and $f(n + 1) = -2f(n) + 3$ for $n \geq 0$, then $f(2)$ is equal to

(1) 1   ● 5

(2) −11   (4) 17

Step 1
Solve for $f(1)$
$$f(0+1) = -2f(0) + 3$$
$$f(1) = -2(2) + 3$$
$$f(1) = -1$$

Step 2
Solve for $f(2)$
$$f(1+1) = -2f(1) + 3$$
$$f(2) = -2(-1) + 3$$
$$f(2) = 2 + 3$$
$$\boxed{f(2) = 5}$$

21 An astronaut drops a rock off the edge of a cliff on the Moon. The distance, $d(t)$, in meters, the rock travels after t seconds can be modeled by the function $d(t) = 0.8t^2$. What is the average speed, in meters per second, of the rock between 5 and 10 seconds after it was dropped?

● 12   (3) 60

(2) 20   (4) 80

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$y = 0.8x^2$

X	Y
5	20
10	80

$$\text{Speed} = \frac{80 - 20 \text{ meters}}{10 - 5 \text{ seconds}}$$
$$= \frac{60}{5}$$
$$\boxed{= 12 \text{ meters/second}}$$

22 When factored completely, the expression $p^4 - 81$ is equivalent to

(1) $(p^2 + 9)(p^2 - 9)$

(2) $(p^2 - 9)(p^2 - 9)$

● $(p^2 + 9)(p + 3)(p - 3)$

(4) $(p + 3)(p - 3)(p + 3)(p - 3)$

perfect squares

$$(p^2 + 9)(p^2 - 9)$$
perfect square

$$(p^2 + 9)(p + 3)(p - 3)$$

23 In 2013, the United States Postal Service charged $0.46 to mail a letter weighing up to 1 oz. and $0.20 per ounce for each additional ounce. Which function would determine the cost, in dollars, $c(z)$, of mailing a letter weighing z ounces where z is an integer greater than 1?
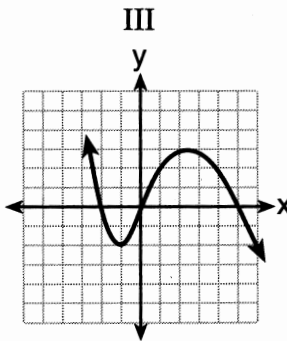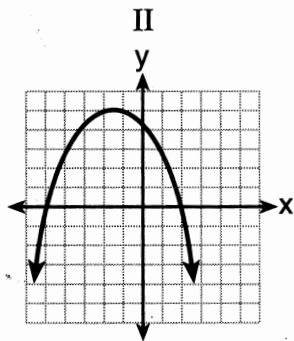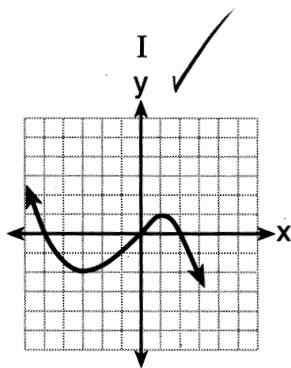
(1) $c(z) = 0.46z + 0.20$ (3) $c(z) = 0.46(z - 1) + 0.20$

(2) $c(z) = 0.20z + 0.46$ ● $c(z) = 0.20(z - 1) + 0.46$ cost of

(handwritten annotations: cost; # ounces minus first ounce; cost of first ounce)

24 A polynomial function contains the factors x, $x - 2$, and $x + 5$. Which graph(s) below could represent the graph of this function?

● I, only   (3) I and III

(2) II, only   (4) I, II, and III

(handwritten work):

$X = 0$ $X - 2 = 0$ $X + 5 = 0$

               $X = 2$ $X = -5$

the function has X intercepts at 0, 2, and -5

Answer all 8 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. [16]

25 Ms. Fox asked her class "Is the sum of 4.2 and $\sqrt{2}$ rational or irrational?" Patrick answered that the sum would be irrational.

State whether Patrick is correct or incorrect. Justify your reasoning.

Patrick is correct.

The sum of a terminating decimal and a non-terminating, non repeating decimal will be a non terminating, non-repeating decimal. The square root of any prime number is a irrational, which makes it a non terminating, non-reapeting decimal.
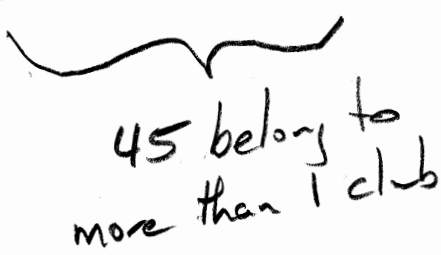
Illustration

$$
\begin{array}{r}
4.2 \\
+\ 1.41421356\ldots \\
\hline
5.61421356\ldots
\end{array}
$$

26 The school newspaper surveyed the student body for an article about club membership. The table below shows the number of students in each grade level who belong to one or more clubs.

	1 Club	2 Clubs	3 or More Clubs
9th	90	33	12
10th	125	12	15
11th	87	22	18
12th	75	27	23

If there are 180 students in ninth grade, what percentage of the ninth grade students belong to more than one club?

0 Clubs   1 Club   2 Clubs   3 or More Clubs   = 180

45   90   33   12

45 belong to more than 1 club

Find % $\frac{45}{180} = \frac{x}{100}$

$4500 = 180x$

$\frac{4500}{180} = x$

$25 = x$

25% belong to more than 1 club.

27 A function is shown in the table below.

x	f(x)
-4	2
-1	-4
0	-2
3	16

$(-4, 1)$

If included in the table, which ordered pair, $(-4,1)$ or $(1,-4)$, would result in a relation that is no longer a function? Explain your answer.

$\boxed{(-4, 1)}$

In a function, for every value of x, there can be one and only one value of f(x). If the ordered pair (-4,1) is included in the table f(-4) would have two values.

28 Subtract $5x^2 + 2x - 11$ from $3x^2 + 8x - 7$. Express the result as a trinomial.

To subtract, change the signs and add

$$3x^2 + 8x - 7$$
$$5x^2 + 2x - 11$$
_____
$$3x^2 + 8x - 7$$
$$-5x^2 - 2x + 11$$
$$\boxed{-2x^2 + 6x + 4}$$

29 Solve the equation $4x^2 - 12x = 7$ algebraically for x.

$$4x^2 - 12x = 7$$

$$4x^2 - 12x - 7 = 0$$

$a = 4$

$b = -12$

$c = -7$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(-7)}}{2(4)}$$

$$x = \frac{12 \pm \sqrt{144 + 112}}{8}$$

$$x = \frac{12 \pm \sqrt{256}}{8}$$

$$x = \frac{12 \pm 16}{8}$$

$$x = \frac{12 + 16}{8} \qquad\qquad x = \frac{12 - 16}{8}$$

$$x = \frac{28}{8} \qquad\qquad\qquad x = \frac{-4}{8}$$

$$x = \frac{7}{2} \qquad\qquad\qquad \boxed{x = \frac{-1}{2}}$$

$$\boxed{x = 3\tfrac{1}{2}}$$

30 Graph the following function on the set of axes below.

$$f(x) = \begin{cases} |x|, & -3 \leq x < 1 \\ 4, & 1 \leq x \leq 8 \end{cases}$$

f(x)

(graph with plotted piecewise function; handwritten annotations: $-3 \leq x < 1$ and $1 \leq x \leq 8$, with -3 and 8 marked on the x-axis)

x
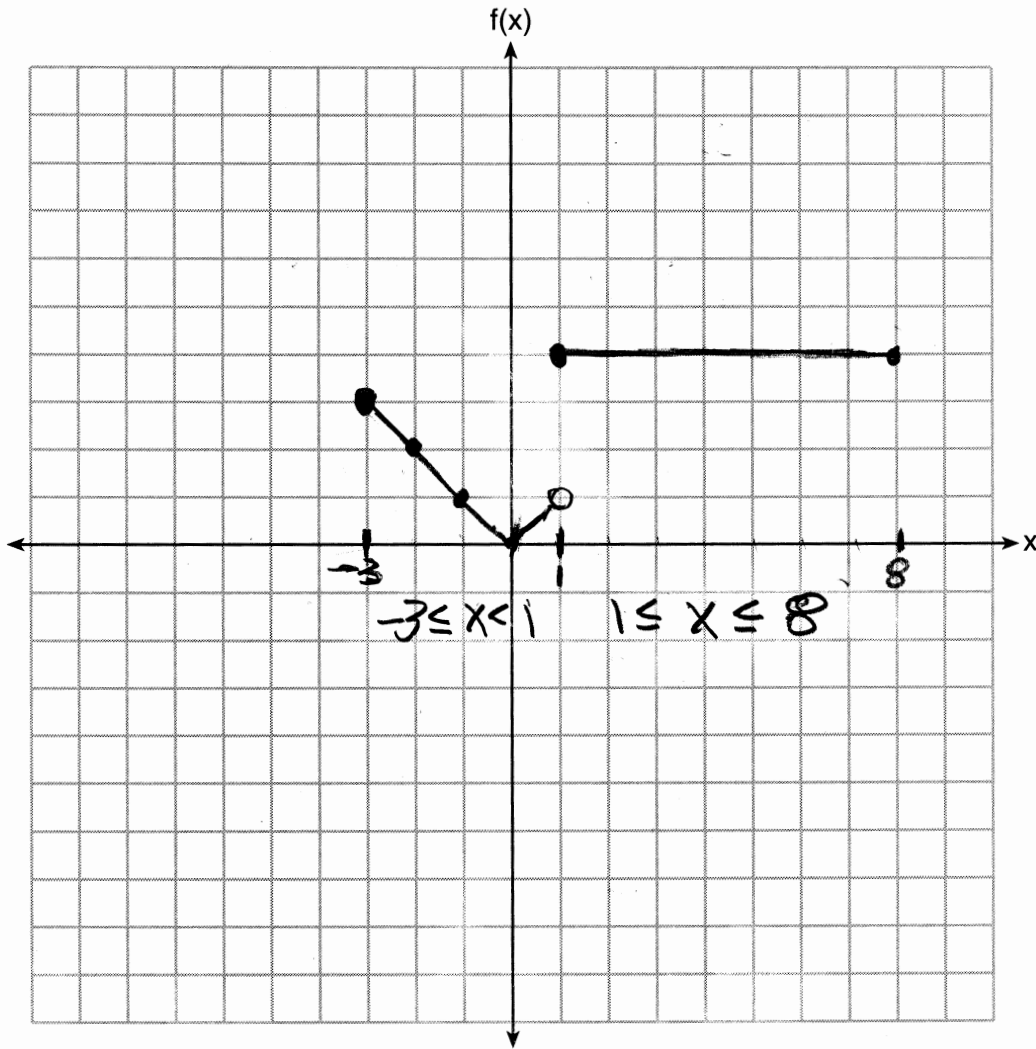
31 A gardener is planting two types of trees:

Type *A* is three feet tall and grows at a rate of 15 inches per year.

Type *B* is four feet tall and grows at a rate of 10 inches per year.

Algebraically determine exactly how many years it will take for these trees to be the same height.

Let x represent the # of years
Let y represent the height in inches

$$y_A = 36 \text{ inches} + 15(x)$$

$$y_B = 48 \text{ inches} + 10x$$

$$36 + 15x = 48 + 10x$$
$$-36 \quad -10x \quad\quad -36 \quad -10x$$
$$5x = 12$$
$$x = \frac{12}{5}$$
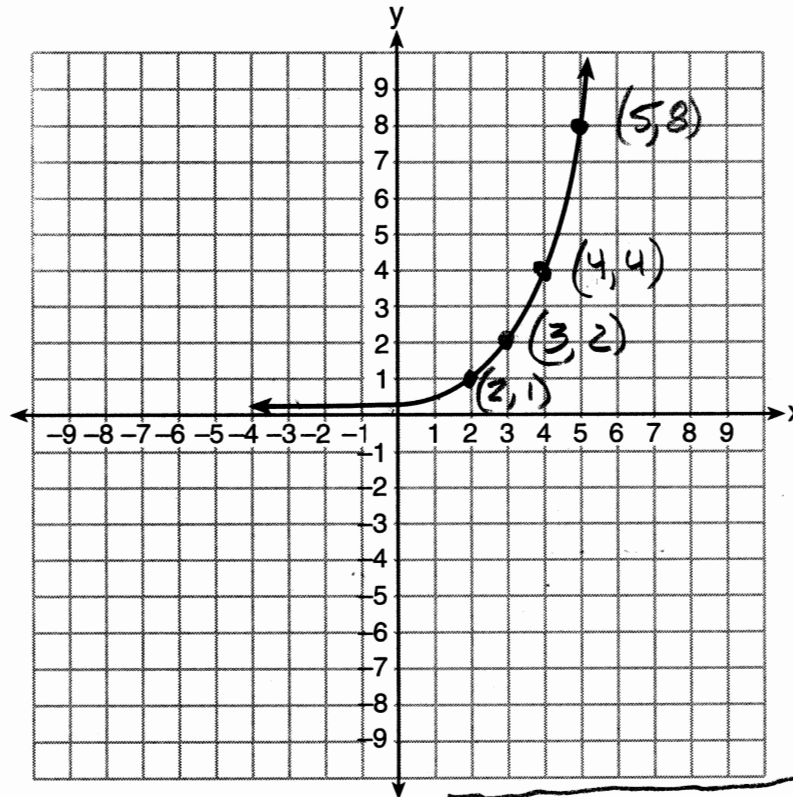$$\boxed{x = 2\frac{2}{5} \text{ years}}$$

Check

$$y_A = 36 + 15(2.4)$$
$$y_A = 72 \text{ inches}$$
$$y_B = 48 + 10(2.4)$$
$$y_B = 72 \text{ inches}$$

32 Write an exponential equation for the graph shown below.

Points shown on graph: $(5, 8)$, $(4, 4)$, $(3, 2)$, $(2, 1)$

Answer $\longrightarrow$

$$y = .25(2)^x$$

check

x	y
0	.25
1	.5
2	1 ✓
3	2 ✓
4	4 ✓
5	8 ✓

Explain how you determined the equation.

$y = ab^x$ is standard form

$(2,1)$ $1 = a(b)^2$

$(3,2)$ $2 = a(b)^3$

$\therefore$ $2a(b)^2 = a(b)^3$

$2b^2 = b^3$

$2 = \dfrac{b^3}{b^2}$

$2 = b$

$\rightarrow$ $y = a(2)^x$

$(4,4)$ $4 = a(2)^4$

$4 = a(16)$

$\dfrac{4}{16} = a$

$\dfrac{1}{4} = a$ $\rightsquigarrow$ $y = \dfrac{1}{4}(2)^x$

Part III

Answer all 4 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. [16]

33 Jacob and Zachary go to the movie theater and purchase refreshments for their friends. Jacob spends a total of $18.25 on two bags of popcorn and three drinks. Zachary spends a total of $27.50 for four bags of popcorn and two drinks.

Write a system of equations that can be used to find the price of one bag of popcorn and the price of one drink.
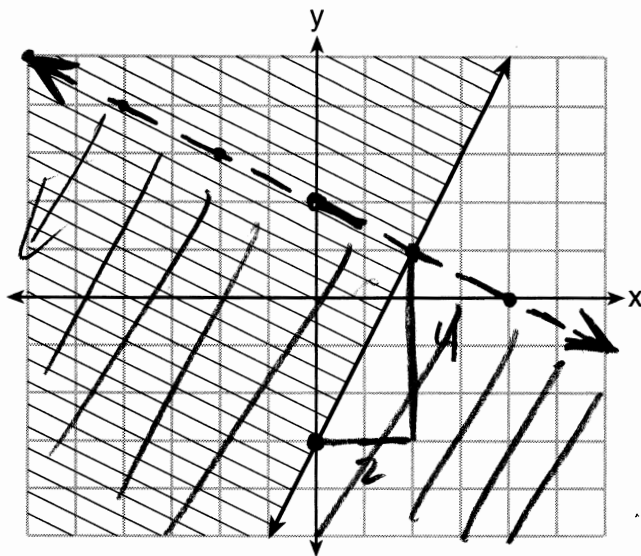
Eq #1 Jacob $2P + 3D = 18.25$

Eq #2 Zachary $4P + 2D = 27.50$

Using these equations, determine and state the price of a bag of popcorn and the price of a drink, to the *nearest cent*.

Eq #1 × 2 $4P + 6D = 36.50$

Eq #2 $4S + 2D = 27.50$

$$4D = \$9^{00}$$

$$\boxed{Drink = \$2^{25}}$$

Eq #1 $2P + 3D = 18.25$

$2P + 3(2.25) = 18.25$

$2P + 6.75 = 18.25$

$ \quad -6.75 \quad -6.75$

$$2P = 11.50$$

$$P = \boxed{\$5.75}$$

check
Eq.1 $2(5.75)+3(2.25)=18.25$
      $18.25 = 18.25 \checkmark$
Eq.2 $4(5.75)+2(2.25)=27.50$
      $27.50 = 27.50$

34 The graph of an inequality is shown below.

$y = mx + b$
$b = -3$
$m = \frac{4}{2} = 2$

a) Write the inequality represented by the graph.

$$Y \geq 2X - 3$$

b) On the same set of axes, graph the inequality $x + 2y < 4$.

$2y < -x + 4$
$y < -\frac{1}{2}x + 2$

c) The two inequalities graphed on the set of axes form a system. Oscar thinks that the point (2,1) is in the solution set for this system of inequalities. Determine and state whether you agree with Oscar. Explain your reasoning.

Oscar is wrong

The point (2, 1) is not a solution of the second equation.

(2,1)

$x + 2y < 4$
$2 + 2(1) < 4$
$4 < 4$ is not true

35 A nutritionist collected information about different brands of beef hot dogs. She made a table showing the number of Calories and the amount of sodium in each hot dog.

$y = ax + b$

$a = 4.59$

$b = -346.6$

$r^2 = .8878$

$r = .942233$

Calories per Beef Hot Dog	Milligrams of Sodium per Beef Hot Dog
186	495
181	477
176	425
149	322
184	482
190	587
158	370
139	322

a) Write the correlation coefficient for the line of best fit. Round your answer to the *nearest hundredth*.

$$r = .94$$

b) Explain what the correlation coefficient suggests in the context of this problem.

The correlation coefficient suggests that there is a very strong relationship between the number of calories per beef hot dog and the milligrams of sodium in the beef hotdog. A perfect correlation would be $r = 1.0$.

36 a) Given the function $f(x) = -x^2 + 8x + 9$, state whether the vertex represents a maximum or minimum point for the function. Explain your answer.

$a < 0$, therefore the parabola opens downward and the vertex is a maximum.

b) Rewrite $f(x)$ in vertex form by completing the square.

Let $g(x) = -f(x)$

$$f(x) = -x^2 + 8x + 9$$

$$g(x) = \frac{-x^2}{-1} + \frac{8x}{-1} + \frac{9}{-1}$$

$$g(x) = x^2 - 8x - 9$$

$$g(x) = (x^2 - 8x + 16) - 16 - 9$$

$$g(x) = (x - 4)^2 - 25$$

$$f(x) = -(x-4)^2 + 25$$

Check: the vertex is $(4, 25)$

Put $y = -x^2 + 8x + 9$ in the graphing calculator + verify that $(4, 25)$ is the vertex ✓

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. 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 written in pencil. [6]

37 New Clarendon Park is undergoing renovations to its gardens. One garden that was originally a square is being adjusted so that one side is doubled in length, while the other side is decreased by three meters.

The new rectangular garden will have an area that is 25% more than the original square garden. Write an equation that could be used to determine the length of a side of the original square garden.

old

s^2 | s

new

$s^2(1.25)$ | s-3

2s

$$(2s)(s-3) = 1.25s^2$$
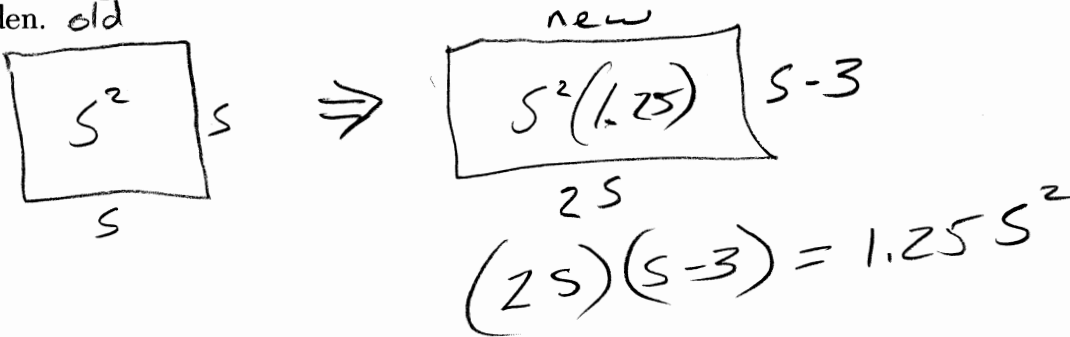
Explain how your equation models the situation.

The length of the square is doubled
The width of the square is reduced by 3
The area of the square is increased by a multiple of 1.25

Determine the area, in square meters, of the new rectangular garden.

$$(2s)(s-3) = 1.25s^2$$
$$2s^2 - 6s = 1.25s^2$$
$$-1.25s^2 + 6s \quad -1.25s^2 + 6s$$
$$.75s^2 = 6s$$
$$.75s = 6$$
$$s = 8 \text{ meters}$$

$$A_\square = 2s(s-3)$$
$$A_\square = 2(8)(8-3)$$
$$A_\square = 16(5)$$
$$A_\square = \boxed{80 \text{ sq. meters}}$$