

## PART 1

- 1) **It takes Tammy 45 minutes to ride her bike 5 miles. At this rate, how long will it take her to ride 8 miles?**  
 (1) 0.89 hour      (2) 1.125 hours      (3) 48 minutes      (4) 72 minutes

Set up your proportion of Minutes to Miles and solve.  
 45 minutes, 5 miles ---- how many minutes for "x" miles.

$$\frac{\text{Minutes}}{\text{Miles}} \quad \frac{45}{5} = \frac{x}{8} \quad \text{Now cross-multiply.}$$

$$5x = 45(8) \quad \text{multiply}$$

$$5x = 360 \quad \text{Divide both sides by 5.}$$

$$x = 72$$

**ANSWER: (4)**

- 2) **What are the roots of the equation  $x^2 - 7x + 6 = 0$ ?**  
 (1) 1 and 7      (2) -1 and 7      (3) -1 and -6      (4) 1 and 6

Factor the given trinomial, set the factors = 0, and then solve for x.

$$x^2 - 7x + 6 = 0$$

$$(x - 1)(x - 6) = 0 \quad \text{Set each factor equal to 0.}$$

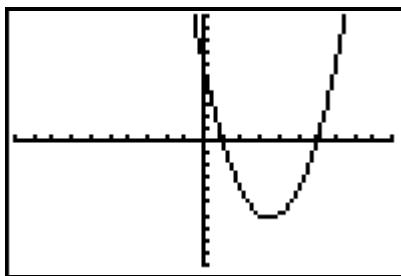
$$x - 1 = 0 \quad \text{Add 1 to each side.}$$

$$x = 1$$

$$x - 6 = 0 \quad \text{Add 6 to each side.}$$

$$x = 6$$

**Alternate solution:** Use your graphing calculator. Enter the trinomial using the Y= editor. Hit your GRAPH key. Below, to the left is a screen capture of your graph.



Represented graphically, the solution set of a quadratic equation will be the points where the parabola intersects the x-axis, as those points will be where the y-axis equals 0.

Looking at the left, it is obvious that the two points of intersection are at  $x = 1$  and  $x = 6$ .

**ANSWER: (4)**

- 3) **Which expression represents  $\frac{27x^{18}y^5}{9x^6y}$  in simplest form?**

(1)  $3x^{12}y^4$

(3)  $18x^{12}y^4$

(2)  $3x^3y^5$

(4)  $18x^3y^5$

The answer begins on the next page...

Here is the problem again:  $\frac{27x^{18}y^5}{9x^6y}$  Simplify by dividing.

$$\frac{27}{9} = 3 \quad \frac{x^{18}}{x^6} = x^{18-6} = x^{12} \quad \frac{y^5}{y} = y^{5-1} = y^4 \quad \text{Final answer: } 3x^{12}y^4 \quad \text{ANSWER: (1)}$$

- 4) **Marie currently has a collection of 58 stamps. If she buys  $s$  stamps each week for  $w$  weeks, which expression represents the total number of stamps she will have?**  
 (1)  $58sw$     (2)  $58 + sw$     (3)  $58s + w$     (4)  $58 + s + w$

If she buys  $s$  stamps each for  $w$  weeks, she will have  $sw$  stamps.

You are told that she is starting with 58 stamps, so she will really have  $58 + sw$  stamps.

**ANSWER: (2)**

- 5) **Which data set describes a situation that could be classified as qualitative?**  
 (1) *the ages of the students in Ms. Marshall's Spanish class*  
 (2) *the test scores of the students in Ms. Fitzgerald's class*  
 (3) *the favorite ice cream flavor of each of Mr. Hayden's students*  
 (4) *the heights of the players on the East High School basketball team*

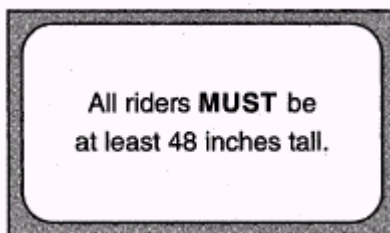
Qualitative data is descriptive, while quantitative data is numerical.

For qualitative think quality and for quantitative think quantity.

Choice 3, above is the only choice dealing with descriptive data. The remaining choices deal with numerical data.

**ANSWER: (3)**

- 6) **The sign shown below is posted in front of a roller coaster ride at the Wadsworth County Fairgrounds.**



**If  $h$  represents the height of a rider in inches, what is a correct translation of the statement on this sign?**

- (1)  $h < 48$     (2)  $h > 4$     (3)  $h \leq 48$     (4)  $h \geq 48$

The sign states, at least 48 inches. This means that 48 inches is the minimum height, but a greater height is certainly good. This is exactly what choice 4 states:  $h$  is greater than or equal to 48.

**ANSWER: (4)**

- 7) Which value of  $x$  is the solution of the equation  $\frac{2x}{3} + \frac{x}{6} = 5$  ?  
 (1) 6 (2) 10 (3) 15 (4) 30

Let's get rid of those denominators by multiplying each term by 18 --the lowest common denominator.

$$18 \cdot \frac{2x}{3} + 18 \cdot \frac{x}{6} = 18 \cdot 5 \quad \text{Cancel the denominators.}$$

$$\begin{aligned} 6 \cdot 2x + 3 \cdot x &= 90 && \text{Multiply} \\ 12x + 3x &= 90 && \text{Simplify} \\ 15x &= 90 && \text{Divide both sides by 15.} \\ x &= 6 \end{aligned}$$

**ANSWER: (1)**

- 8) Students in Ms. Nazzeer's mathematics class tossed a six-sided number cube whose faces are numbered 1 to 6. The results are recorded in the table below.

Result	Frequency
1	3
2	6
3	4
4	6
5	4
6	7

Based on these data, what is the empirical probability of tossing a 4?

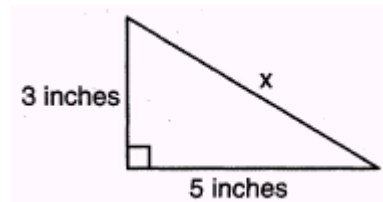
- (1)  $\frac{8}{30}$  (3)  $\frac{5}{30}$   
 (2)  $\frac{6}{30}$  (4)  $\frac{1}{30}$

Using the data shown in the chart above, you are asked for  $P(4)$  -- the probability of tossing a 4. To determine how many times the coin was tossed, simply get the sum of the frequency column. It adds up to 30. Out of that 30, a 4 was tossed 6 times.

The probability, therefore, of tossing a 4 is  $6/30$ .

**ANSWER: (2)**

- 9) What is the value of  $x$ , in inches, in the right triangle below?



- (1)  $\sqrt{15}$  (3)  $\sqrt{34}$   
 (2) 8 (4) 4

Whenever you are presented with a right triangle and are given two of its sides, you can always determine the third side by using the Pythagorean Theorem: The hypotenuse squared, equals the sum of the square of the legs. In the case above,  $x$  is the hypotenuse. Set up your equation and solve.

$$x^2 = 3^2 + 5^2 \quad \text{Simplify.}$$

$$x^2 = 9 + 25 \quad \text{Simplify.}$$

$$x^2 = 34 \quad \text{Find square root of both sides.}$$

$$x = \sqrt{34}$$

**ANSWER: (3)**

- 10) **What is  $\sqrt{32}$  expressed in simplest radical form?**

(1)  $16\sqrt{2}$

(3)  $4\sqrt{8}$

(2)  $4\sqrt{2}$

(4)  $2\sqrt{8}$

$$\sqrt{32}$$

$$\sqrt{16} \cdot \sqrt{2}$$

$$4\sqrt{2}$$

Factor, using at least one perfect square.

Simplify.

**ANSWER: (2)**

- 11) **If the speed of sound is 344 meters per second, what is the approximate speed of sound, in meters per hour?**

60 seconds = 1 minute
60 minutes = 1 hour

(1) 20,640

(2) 41,280

(3) 123,840

(4) 1,238,400

Nope, that is not an error. You are actually being told how to convert from seconds to minutes, to hours.

You are given a speed of 344 meters per second. To convert that to minutes, multiply by 60.  $344 \times 60 = 20,640$  Now, to convert the minutes to hours, multiply again by 60.

$$20,640 \times 60 = \mathbf{1,238,400}$$

Or you could simply multiply the 344 by 3600.

**ANSWER: (4)**

- 12) **The sum of two numbers is 47, and their difference is 15. What is the larger number?**

(1) 16

(2) 31

(3) 32

(4) 36

If the sum of two numbers is 47, then  $x$  can represent one of the numbers, while  $47 - x$  will represent the other number. (You can designate either number as the larger to obtain a difference of 15).

Define your variables and set up your equation.

Let  $x$  = greater number

$47 - x$  = smaller number

$$x - (47 - x) = 15$$

problem continues on next page

$$\begin{aligned}
 x - (47 - x) &= 15 && \text{Subtract (signs in parenthesis change)} \\
 x - 47 + x &= 15 && \text{Combine like terms.} \\
 2x - 47 &= 15 && \text{Add 47 to each side.} \\
 2x &= 62 && \text{Divide both sides by 2.} \\
 x &= 31
 \end{aligned}$$

**Easier alternate solution:**Let  $x$  = greater number.Let  $y$  = smaller number.

$$\begin{aligned}
 x + y &= 47 && \text{Their sum is 47.} \\
 x - y &= 15 && \text{Their difference is 15. (Now add these two equations.)} \\
 \hline
 2x &= 62 && \text{Divide both sides by 2.} \\
 x &= 31
 \end{aligned}$$

**ANSWER: (2)**

- 13)
- If  $a + ar = b + r$ , the value of  $a$  in terms of  $b$  and  $r$  can be expressed as**

(1)  $\frac{b}{r} + 1$

(3)  $\frac{b+r}{1+r}$

(2)  $\frac{1+b}{r}$

(4)  $\frac{1+b}{r+b}$

$$\begin{aligned}
 a + ar &= b + r && \text{Factor the left side of the equation.} \\
 a(1+r) &= b + r && \text{Now divide both sides by } 1+r \\
 a &= \frac{b+r}{1+r}
 \end{aligned}$$

**ANSWER: (3)**

- 14)
- Which value of  $x$  is in the solution set of  $\frac{4}{3}x + 5 < 17$ ?**

(1) 8

(2) 9

(3) 12

(4) 16

$$\frac{4}{3}x + 5 < 17 \quad \text{Multiply each term by 3, to cancel denominator.}$$

$$3 \cdot \frac{4}{3}x + 3 \cdot 5 < 3 \cdot 17$$

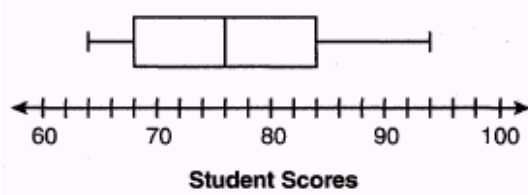
$$4x + 15 < 51 \quad \text{Subtract 15 from each side.}$$

$$4x < 36 \quad \text{Divide both sides by 4.}$$

$$x < 9 \quad \text{x is less than 9.}$$

**ANSWER: (1)**

- 15)
- The box-and-whisker plot below represents students' scores on a recent English test.**



What is the value of the upper quartile?

(1) 68

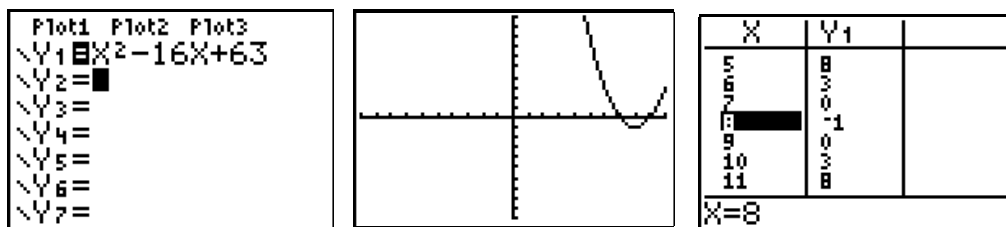
(3) 84

(2) 76

(4) 94



Enter the equation into your graphing calculator and hit the **GRAPH** key. You can see most of the parabola below. You see the y-coordinates decreasing until they reach the **turning point**, which is also **known as the vertex**, and then begin to increase. You can also see a table of values for this parabola by hitting the **TABLE** key. To access the table key you would first hit the **2nd** key followed by **GRAPH**. You can then scroll through the values until you reach the lowest y-value. You can see the coordinates in the table below. **The vertex is the point (8, -1)**. The axis of symmetry is the vertical line that would split the parabola in half. The turning point is always on the axis of symmetry. **The equation for this axis of symmetry is  $x=8$ .**

**Algebraic solution:**

You can also determine the axis of symmetry algebraically.

As you recall, a quadratic equation can be represented in the form of  $ax^2 + bx + c = 0$

The equation for the axis of symmetry is:  $x = \frac{-b}{2a}$

In our equation,  $y = x^2 - 16x + 63$ ,  $a = 1$  and  $b = -16$ . Let us substitute:

$$x = \frac{-b}{2a} = \frac{-(-16)}{2(1)} = \frac{16}{2} = 8 \quad \mathbf{x = 8 \text{ is the equation of the axis of symmetry.}}$$

Once you know the axis of symmetry you can now substitute its value in the equation to obtain the corresponding y-coordinate to determine the vertex, or turning point.

$$y = x^2 - 16x + 63$$

$$y = 8^2 - 16(8) + 63$$

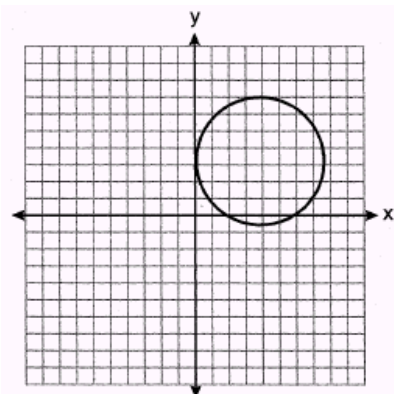
$$y = 64 - 128 + 63$$

$$y = -1$$

**(8, -1) is the vertex.**

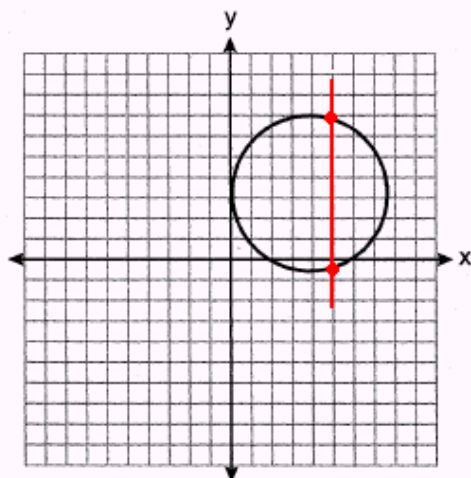
**ANSWER: (1)**

- 19) **Which statement is true about the relation shown on the graph below?**



- (1) **It is a function because there exists one x-coordinate for each y-coordinate.**
- (2) **It is a function because there exists one y-coordinate for each x-coordinate.**
- (3) **It is not a function because there are multiple y-values for a given x-value.**
- (4) **It is not a function because there are multiple x-values for a given y-value.**

Answer begins on next page



A function is a relation in which every element in the domain will correspond to exactly one element in the range. The domain consists of your x-coordinates; the range consists of your y-coordinates. (x comes before y, and d comes before r). When looking at a set of ordered pairs defining a function, no two different y-coordinates can share the same x-coordinate. This means that any x-value will result in one unique y-value.

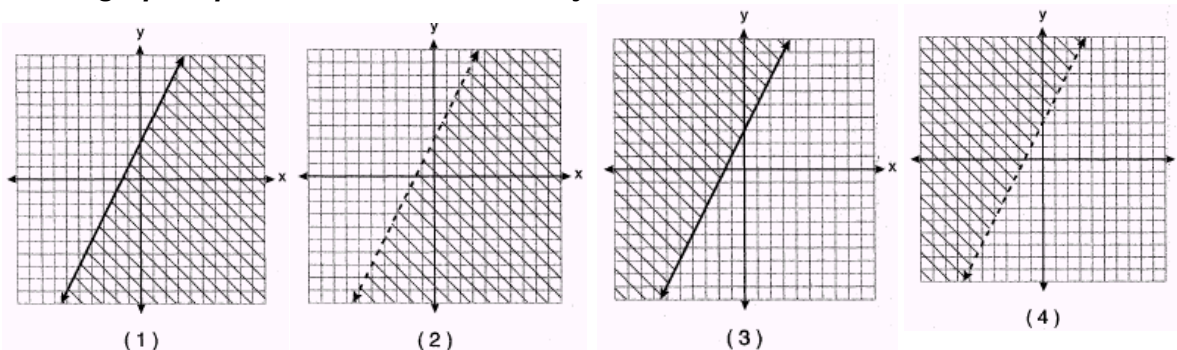
When presented with a graph it is therefore easy to determine if it represents a function. If you can draw a vertical line and have the line intersect more than one point, then the graph does not represent a function.

As you can see above, the vertical red line I drew is just one of many that can be drawn. You clearly see that for its x-coordinate of 5, there are two y-coordinates. It therefore fails the vertical line test and does not define a function. Choice 3 is your answer:

**It is not a function because there are multiple y-values for a given x-value.**

**ANSWER: (3)**

- 20) Which graph represents the solution of  $3y - 9 \leq 6x$ ?



Step 1. Transpose the given inequality into the slope intercept form.

$$3y - 9 \leq 6x \quad \text{Add 9 to each side.}$$

$$3y \leq 6x + 9 \quad \text{Divide each term by 3.}$$

$$y \leq 2x + 3 \quad \text{It is now in the form of } mx + b.$$

The inequality reads "less than or equal." **That is what is shown in choice 1.**

Choice 2 shows only "less than."

Choice 3 shows "greater than or equal." (solid line indicates equal)

Choice 4 shows only "greater than."

**ANSWER: (1)**

- 21) Which expression represents  $\frac{x^2 - 2x - 15}{x^2 + 3x}$  in simplest form?

(1)  $-5$

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

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

(4)  $\frac{-2x - 15}{3x}$

Step 1 involves factoring both the numerator and denominator, and then canceling common factors.

$$\frac{x^2 - 2x - 15}{x^2 + 3x} = \frac{(x+3)(x-5)}{x(x+3)} = \frac{\cancel{(x+3)}(x-5)}{x\cancel{(x+3)}} = \frac{(x-5)}{x}$$

ANSWER: (2)

- 22) **What is an equation of the line that passes through the point (4,-6) and has a slope of -3?**

(1)  $y = -3x + 6$

(2)  $y = -3x - 6$

(3)  $y = -3x + 10$

(4)  $y = -3x + 14$

The easiest method to use for determining an equation of a line when given its slope and one point, is the point slope form of a line. It is  $y - y_1 = m(x - x_1)$ .  $m$  represents the slope,  $x_1$  and  $y_1$  represent the coordinates of the given point,  $x$  and  $y$  represent the coordinates of another point.

In our problem the slope is -3 and the given point is (4, 6). All you do now is substitute.

$x_1$  is 4                       $y_1$  is 6                       $m$  is -3

$$y - y_1 = m(x - x_1)$$

$$y - 6 = -3(x - 4) \quad \text{Use the distributive property.}$$

$$y - 6 = -3x + 12 \quad \text{Add 6 to both sides.}$$

$$y = -3x + 6$$

**Alternate solution using slope intercept form of a line:  $y = mx + b$**

$m$  represents the slope     $b$  represents  $y$ -intercept    point given (4, -6)

$$y = mx + b \quad \text{Substitute all givens} \quad m = -3 \quad b = ? \quad x = 4 \quad y = -6$$

$$-6 = -3(4) + b \quad \text{Simplify}$$

$$-6 = -12 + b \quad \text{Add 12 to both sides.}$$

$$6 = b \quad \text{You now know that } m = -3 \text{ and } b = 6$$

$$y = mx + b \quad \text{Substitute}$$

$$y = -3x + 6 \quad \text{This is your equation.}$$

ANSWER: (1)

- 23) **When  $4x^2 + 7x - 5$  is subtracted from  $9x^2 - 2x + 3$ , the result is**

(1)  $5x^2 + 5x - 2$

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

(2)  $5x^2 - 9x + 8$

(4)  $-5x^2 + 9x - 8$

Read the problem carefully so you understand what is being subtracted from what.

In the case above it is:

$$9x^2 - 2x + 3 - (4x^2 + 7x - 5) \quad \text{The minus in front of the parenthesis signals a sign change for the terms within the parenthesis.}$$

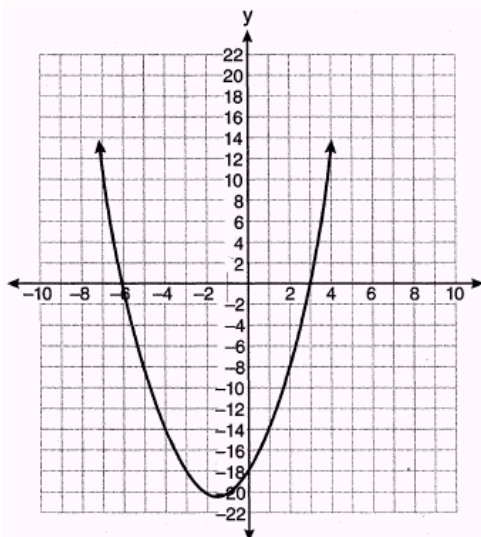
$$9x^2 - 2x + 3 - 4x^2 - 7x + 5 \quad \text{Combine like terms.}$$

$$5x^2 - 9x + 8$$

ANSWER: (2)

#24 begins on the next page

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



*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

The graph at the left is that of a parabola. The solution set, or roots of its equation will be the points at which it intersects the x-axis. As you can see, this parabola intersects the x-axis at two points. The x-coordinates of those points, **the roots of the equation, are 3 and -6.**

**ANSWER: (3)**

- 25) *What is the value of the y-coordinate of the solution to the system of equations  $x + 2y = 9$  and  $x - y = 3$ ?*  
 (1) 6    (2) 2    (3) 3    (4) 5

Line up the two equations. Subtract one from the other to solve for y.  
 (The signs of what is being subtracted change)

$$\begin{array}{r} x + 2y = 9 \\ -(x - y = 3) \\ \hline 3y = 6 \end{array} \quad \begin{array}{r} x + 2y = 9 \\ -x + y = -3 \\ \hline 3y = 6 \end{array} \quad \begin{array}{l} \text{Divide by 3.} \\ y = 2 \end{array}$$

**ANSWER: (2)**

- 26) *What is the additive inverse of the expression  $a - b$ ?*  
 (1)  $a + b$     (2)  $a - b$     (3)  $-a + b$     (4)  $-a - b$

The sum of the additive inverse of an expression and the expression will equal the additive identity. The additive identity is 0. All you have to do is change the signs of each term. Therefore, **the additive inverse of  $a - b$  will be  $-a + b$ .**  
 Their sum will be 0.

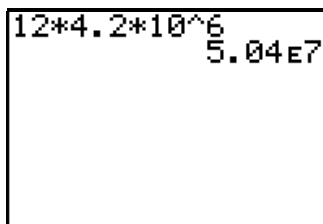
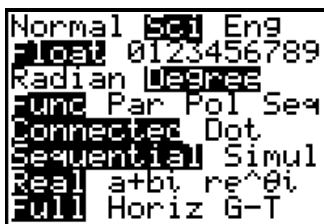
(By the way that is what you did in the previous problem where you changed  $x - y = 3$  to  $-x + y = -3$ . You also used the additive inverse in number 23 on this exam. When you subtract it is always the same as changing the number being subtracted to its additive inverse, and then adding.)

**ANSWER: (3)**

- 27) *What is the product of 12 and  $4.2 \times 10^6$  expressed in scientific notation?*  
 (1)  $50.4 \times 10^6$     (2)  $50.4 \times 10^7$     (3)  $5.04 \times 10^6$     (4)  $5.04 \times 10^7$

Answer begins on next page

You can put your calculator into scientific mode by hitting the **MODE** key, moving the blinking cursor over "sci", and hitting **ENTER**. Next enter the problem the way you see it below. Your answer appears in scientific notation. The integer following E is the exponent to the base 10. In other words your calculator display for  $5.04 \times 10^7$  is 5.04E7. (Don't forget to put your calculator back to normal mode.)



ANSWER: (4)

- 28) **To calculate the volume of a small wooden cube, Ezra measured an edge of the cube as 2 cm. The actual length of the edge of Ezras cube is 2.1 cm. What is the relative error in his volume calculation to the nearest hundredth?**  
 (1) 0.13      (2) 0.14      (3) 0.15      (4) 0.16

The relative error will be the difference between the two volumes (the actual volume and Ezra's volume), divided by the actual volume.

The volume of cube can be found by raising its edge to the 3<sup>rd</sup> power.  $V = e^3$   
 (Volume is the length x width x height. In a cube these three dimensions are equal.)

Actual volume =  $(2.1)^3 = 9.261$     Ezra's volume =  $2^3 = 8$

Difference in volumes =  $9.261 - 8 = 1.261$

Difference divided by actual volume =  $1.261 \div 9.261 = .136$

To nearest hundredth, .136 is **0.14**.

ANSWER: (2)

- 29) **What is  $\frac{6}{4a} - \frac{2}{3a}$  expressed in simplest form?**

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

(3)  $\frac{8}{7a}$

(2)  $\frac{5}{6a}$

(4)  $\frac{10}{12a}$

Change to equivalent fractions with common denominator.

The common denominator is 12a.

Multiply first fraction by 3/3 and second fraction by 4/4.

$$\frac{3}{3} \cdot \frac{6}{4a} - \frac{4}{4} \cdot \frac{2}{3a} = \frac{18}{12a} - \frac{8}{12a} = \frac{10}{12a} = \frac{5}{6a}$$

ANSWER: (2)

- 30) **The set {11,12} is equivalent to**  
 (1)  $\{x \mid 11 < x < 12, \text{ where } x \text{ is an integer}\}$   
 (2)  $\{x \mid 11 < x \leq 12, \text{ where } x \text{ is an integer}\}$   
 (3)  $\{x \mid 10 \leq x < 12, \text{ where } x \text{ is an integer}\}$   
 (4)  $\{x \mid 10 < x \leq 12, \text{ where } x \text{ is an integer}\}$

Integers include 0, the counting numbers, and their opposites (negatives).

Choice 1 is the set of integers greater than 11 and less than 12 = { }

Choice 2 is the set of integers greater than 11 and less than or equal to 12 = {12}

Choice 3 is the set of integers greater than or equal to 10 and less than 12 = {10, 11}

**Choice 4 is the set of integers greater than 10 and less than or equal to 12 = {11, 12}**

ANSWER: (4)

## PART II

- 31) **Determine how many three-letter arrangements are possible with the letters A, N, G, L, and E if no letter may be repeated.**

Using the counting principle:

You have 5 choices for the first letter, 4 choices for the second, and 3 for the third.

**$5 \cdot 4 \cdot 3 = 60$  arrangements.**

Or the problem involves a permutation of 5 letters taken 3 at a time:

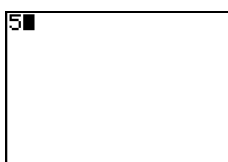
$${}_5P_3 = 5 \cdot 4 \cdot 3 = 60$$

You can also use your calculator to determine the value of  ${}_5P_3$ .

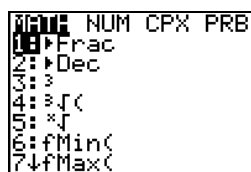
(1) enter 5. (2) hit the **MATH** key. (3) scroll right to PRB to access the probability menu.

(4) select 2 on the menu. (5) enter a 3. (6) hit ENTER for your answer.

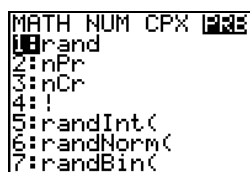
(1)



(2)



(3)



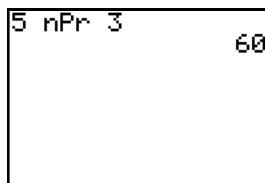
(4)



(5)



(6)



**ANSWER: There are 60 three-letter arrangements.**

- 32) **Factor completely:  $4x^3 - 36x$**

First factor out  $4x$  (common to both terms).

$$4x(x^2 - 9) \quad \text{Now factor the difference of two squares.}$$

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

**ANSWER:  $4x(x + 3)(x - 3)$**

- 33) **Some books are laid on a desk. Two are English, three are mathematics, one is French, and four are social studies. Theresa selects an English book and Isabelle then selects a social studies book. Both girls take their selections to the library to read. If Truman then selects a book at random, what is the probability that he selects an English book?**

Starting with:

2 English

3 Math

1 French

4 Social Studies

Theresa & Isabelle take:

1 English

1 Social Studies

Books remaining:

1 English

3 Math

1 French

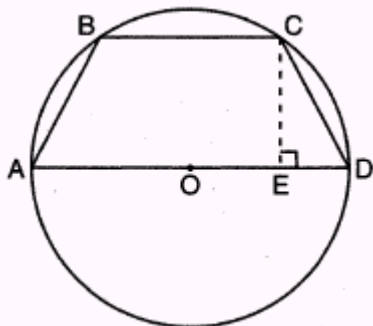
3 Social Studies

8 books total

**ANSWER: Probability of selecting an English book is  $\frac{1}{8}$ .**

## Part III

- 34) *In the diagram below, the circumference of circle  $O$  is  $16\pi$  inches. The length of  $\overline{BC}$  is three-quarters of the length of diameter  $\overline{AD}$  and  $CE = 4$  inches. Calculate the area, in square inches, of trapezoid  $ABCD$ .*



The area of a trapezoid equals  $\frac{1}{2}$  the sum of its bases times the height.

$$A = \frac{1}{2} (b_1 + b_2) h \quad \text{or as presented on your}$$

$$\text{reference sheet as: } A = \frac{1}{2} h(b_1 + b_2)$$

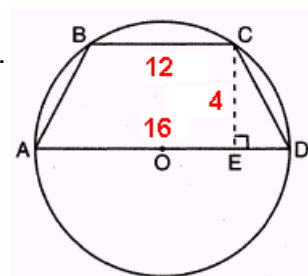
One base is the diameter  $\overline{AD}$ , the other base is line segment  $BC$ .

First let us determine the diameter. You are told that the circumference is  $16\pi$ . Since the circumference equals "pi" times the diameter, the **diameter** in the above case must equal **16** (making the circumference equal  $16\pi$ ). You are told that  $\overline{BC}$  is  $\frac{3}{4}$  of the diameter:  $\frac{3}{4} (16) = 12$

The diagram at the right shows the information you now have.

$$b_1 = 16 \quad b_2 = 12 \quad h = 4 \quad A = \frac{1}{2} (b_1 + b_2) h$$

$$\frac{1}{2} (b_1 + b_2) h = \frac{1}{2} (16+12)(4) = \frac{1}{2} (28)(4) = (14)(4) = 56$$



**ANSWER:** The area of the trapezoid is 56 square inches.

- 35) *A bank is advertising that new customers can open a savings account with a  $3\frac{3}{4}\%$  interest rate compounded annually. Robert invests \$5,000 in an account at this rate. If he makes no additional deposits or withdrawals on his account, find the amount of money he will have, to the nearest cent, after three years.*

You should know that  $3\frac{3}{4}\%$  equals 3.75%. As a decimal, that is **.0375**.

You can always convert  $3\frac{3}{4}\%$  to the improper fraction of  $\frac{15}{4}\%$ . Now you can divide 15 by 4 and obtain the answer of 3.75%. To convert a percent to a decimal, move the decimal point two places to the left, and your answer in this case becomes **.0375**.

To determine how much money Robert will have after 1 year, you can determine his interest for 1 year by multiplying 5000 by **.0375**, and adding that interest to the 5,000. It is however easier to multiply 5,000 by **1.0375** saving yourself the step of addition.

After 1 year Robert will have  $5,000(1.0375)$

After 2 years Robert will have the amount above, times 1.0375 or  
 $(5,000 \cdot 1.0375)(1.0375)$

After 3 years it will be  $(5,000 \cdot 1.0375 \cdot 1.0375)(1.0375)$

The problem can be made even easier. It falls under the topic of exponential growth.

All you really have to do to solve it is:  $5,000(1.0375)^3 = \$5583.857422$

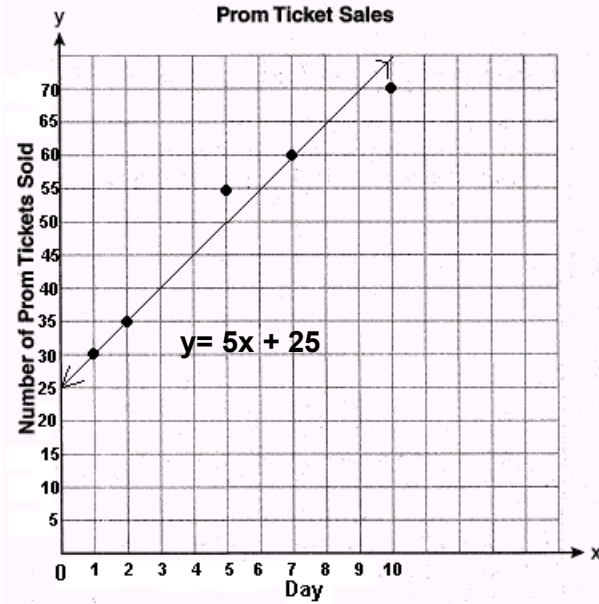
**ANSWER:** To the nearest cent Robert will have **\$5,583.86**.

36) The table below shows the number of prom tickets sold over a ten-day period.

Prom Ticket Sales

Day (x)	1	2	5	7	10
Number of Prom Tickets Sold (y)	30	35	55	60	70

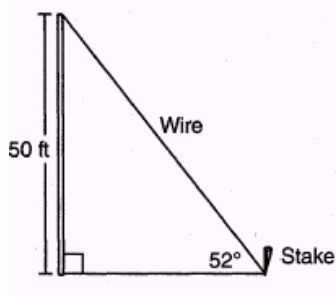
Plot these data points on the coordinate grid below. Use a consistent and appropriate scale. Draw a reasonable line of best fit and write its equation.



A line of best fit is a line that approximates the data plotted. In the case at the left, you notice that a straight line was able to be drawn through three of the points. The line has a slope of 5. (Remember that each unit on the y-axis is really 5). If extended, the line intersects the y-axis at 25. It is therefore a line with a slope of 5 and a y-intercept of 25, making its equation:  
 $y = 5x + 25$

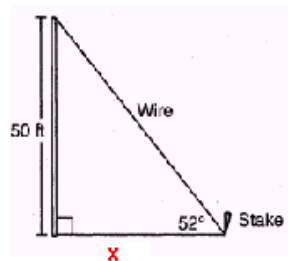
Part IV

37) A stake is to be driven into the ground away from the base of a 50-foot pole, as shown in the diagram below. A wire from the stake on the ground to the top of the pole is to be installed at an angle of elevation of 52°.



How far away from the base of the pole should the stake be driven in, to the nearest foot?

What will be the length of the wire from the stake to the top of the pole, to the nearest foot?



Sine, cosine, and tangent are ratios involving the sides of a right triangle. Regarding the first question, you are asked for the distance from the base of the pole to the stake. Let X be that length, as you see in the diagram at the right.

The three trigonometric ratios are:

$$\sin = \frac{\text{opposite}}{\text{hypotenuse}} \quad \cos = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \tan = \frac{\text{opposite}}{\text{adjacent}}$$

Relative to the 52 degree angle, the 50 foot pole is an opposite, and the red x is adjacent. The tangent ratio uses the opposite and adjacent:  $\text{tangent} = \frac{\text{opposite}}{\text{adjacent}}$

Substitute the knowns:

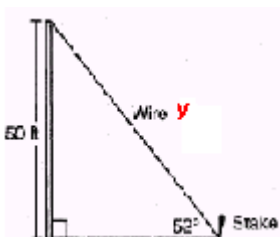
$$\tan 52 = \frac{50}{x} \quad \text{Multiply both sides by } x.$$

$$x (\tan 52) = 50 \quad \text{Divide both sides by } \tan 52.$$

$$x = \frac{50}{\tan 52} \quad \text{Use calculator to divide 50 by } \tan 52 \quad \frac{50/\tan(52)}{39.06428133}$$

**x = 39 to nearest foot.**

**ANSWER: The stake is 39 feet from the base of the pole.**



For the final question, the length of the wire, let y equal the length of the wire. Now, relative to the angle of 52 degrees, the pole of 50 is opposite, and the y is the hypotenuse. The sine ratio uses the opposite and hypotenuse.

$$\sin = \frac{\text{opposite}}{\text{hypotenuse}} \quad \text{Substitute what is given.}$$

$$\sin 52 = \frac{50}{y} \quad \text{Multiply both sides by } y.$$

$$y (\sin 52) = 50 \quad \text{Divide both sides by } \sin 52.$$

$$y = \frac{50}{\sin 52} \quad \text{Use calculator to divide 50 by sine } 52 \quad \frac{50/\sin(52)}{63.45091075}$$

**y = 63 to nearest foot.**

**ANSWER: The length of the wire is 63 feet.**

- 38) **The Fahrenheit temperature readings on 30 April mornings in Stormville, New York, are shown below.**

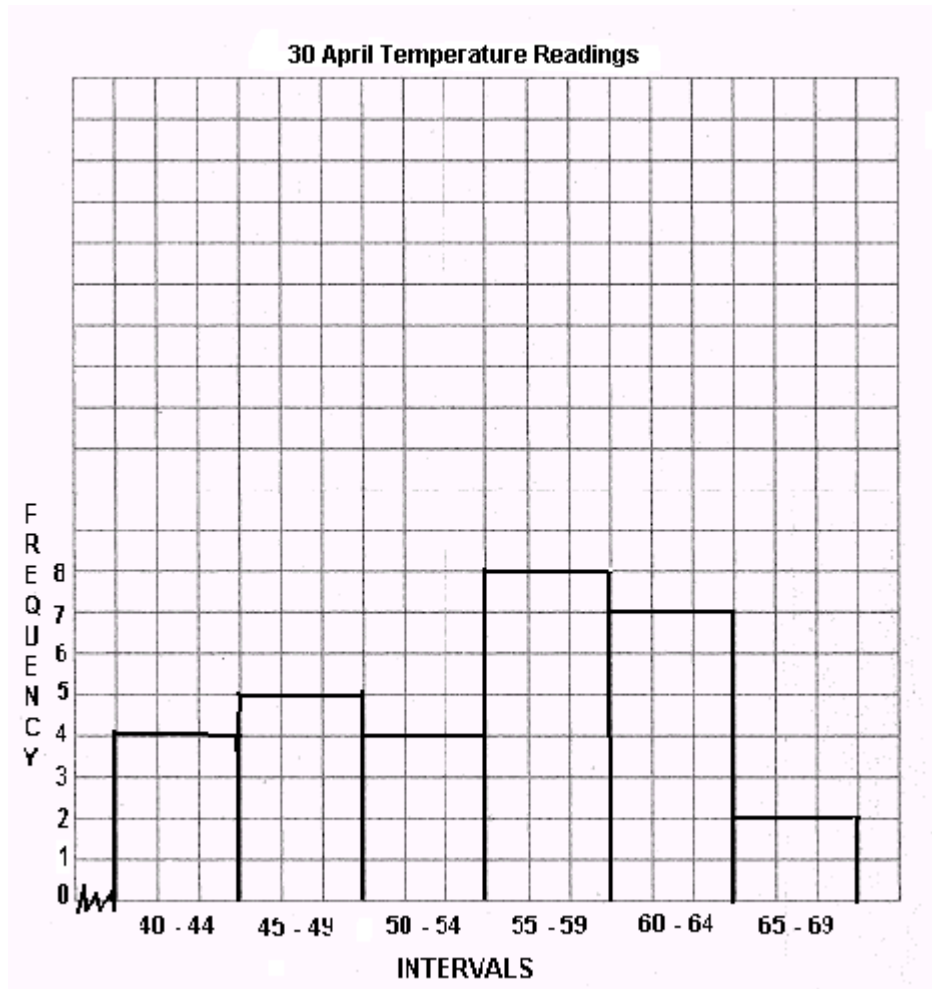
**41°, 58°, 61°, 54°, 49°, 46°, 52°, 58°, 67°, 43°, 47°, 60°, 52°, 58°, 48°, 44°, 59°, 66°, 62°, 55°, 44°, 49°, 62°, 61°, 59°, 54°, 57°, 58°, 63°, 60°**

**Using the data, complete the frequency table below.**

Interval	Tally	Frequency
40-44		4
45-49		5
50-54		4
55-59		8
60-64		7
65-69		2

In red, at the left, is the completed frequency table.

**On the grid on the next page, construct and label a frequency histogram based on the table,**



- 39) ***On the set of axes below, solve the following system of equations graphically for all values of  $x$  and  $y$ .***

$$y = x^2 - 6x + 1$$

$$y + 2x = 6$$

Using your graphing calculator, you can easily generate a table of values for each given equation.

Answer continues on next page...

Plot1 Plot2 Plot3		
Y1	$X^2 - 6X + 1$	
Y2	=	
X	Y1	
0	1	
1	-4	
2	-7	
3	-8	
4	-7	
5	-4	
6	1	
X=5		

X	Y1	
0	1	
1	-4	
2	-7	
3	-8	
4	-7	
5	-4	
6	1	
X=3		

Let's work with the quadratic equation first. Enter it using the y= editor. Next, hit the 2nd key followed by **GRAPH** to access the **TABLE**. The result can be seen at the left. Don't get scared if your table looks different. The next step is a repeat of what you did for number 18 on this Regents. The parabola that you will be graphing opens to the top since the  $x^2$  does not have a negative sign in front of it. That means that it will have a minimum turning point. While viewing your table, scroll in a direction so that the values for  $Y_1$  decrease. Look at the third screen capture to the left. Those will be the values that will give you a symmetrical parabola. You can see that its turning point is (3, -8), and you will have 3 points above it and 3 below.

x	$x^2 - 6x + 1$	y
0	$0^2 - 6(0) + 1$	1
1		-4
2		-7
3		-8
4		-7
5		-4
6		1

Now, set up a small table on your sheet showing the points you are graphing. The table should be similar to the one you see at the left. If you wish, you can complete each line the way I did the first line, showing the x values being substituted in the equation. The table shows the coordinates you will use for your parabola.

Now for your linear equation. First change  $y + 2x = 6$  into  $y = mx + b$  form.

$y + 2x = 6$  Subtract 2x from both sides.

$y = -2x + 6$  You can now enter it into your calculator, below the quadratic equation already there. Don't forget to use the (-) key for the negative sign for the 2. Using the regular subtraction key will result in an error.

As before, bring up the **TABLE** screen.

You can use the first 3 points you see. For this second equation you will **use the  $Y_2$  values** as the y-coordinates.

As before, set up a little table on your paper.

Again, you don't really have to complete the middle column, or even include it, as your calculator did all the work.

x	$-2x + 6$	y
0	$-2(0) + 6$	6
1		4
2		2

Plot1 Plot2 Plot3		
Y1	$X^2 - 6X + 1$	
Y2	$-2X + 6$	
Y3	=	
X	Y1	Y2
0	1	6
1	-4	4
2	-7	2
3	-8	0
4	-7	-2
5	-4	-4
6	1	-6
X=0		

The graph and solution set appear on the next page.

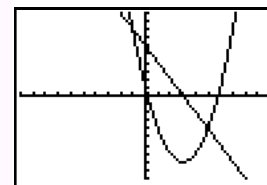
Again, here are the two tables of values that you will be using.

x	$x^2 - 6x + 1$	y
0	$0^2 - 6(0) + 1$	1
1		-4
2		-7
3		-8
4		-7
5		-4
6		1

x	$-2x + 6$	y
0	$-2(0) + 6$	6
1		4
2		2

Now for an explanation of the graph you see below, specifically, the point  $(-1, 8)$  which does not appear in either table at the left.

Hit the **GRAPH** key to view what your graphs should look like.

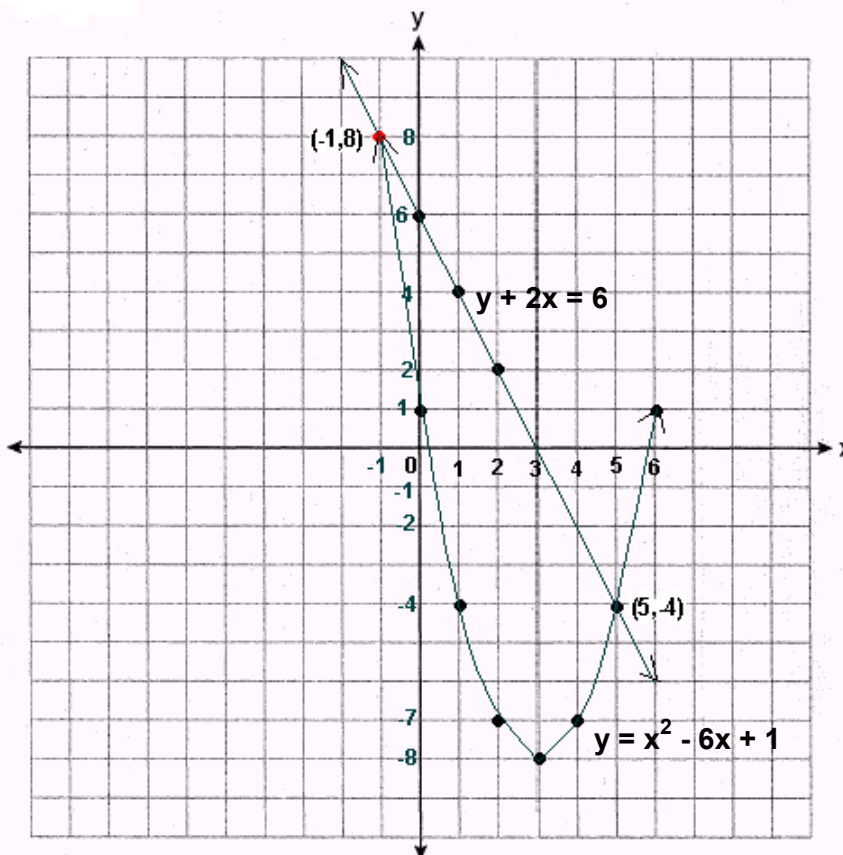


You see that they should be intersecting at two points. The bottom point  $(5, 4)$ , appeared on the table of values. Here's how to find that the other point of intersection is  $(-1, 8)$ .

Look at the screen capture below.

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

X = -1



The screen capture clearly shows that one point of intersection takes place when  $x = 5$ . Both  $y$ 's are equal at that point. You see the same when  $x = -1$ ; both  $y$ 's are again equal. When  $x = -1$ , both  $y$ 's equal 8, making this point of intersection  $(-1, 8)$ .

**The two points of intersection determine your solution set.**

**ANSWER:** For the given equations, the solution set is  $\{(-1, 8), (5, -4)\}$  or stated differently, when  $x = -1$   $y = 8$  and when  $x = 5$   $y = -4$ .