

# ANNAPOLIS VALLEY REGIONAL SCHOOL BOARD



## Mathematics 11 Sample Examination Questions

Name: \_\_\_\_\_

### Instructions

1. There are 22 selected response questions. Each question is worth 1 point.
2. Consider the four choices for each question, select the best one, and then fill in the circle in front of the best answer. It is not necessary to show your work for the selected response questions.
3. You may mark on the diagrams and questions in the booklet, and use any available space as scrap paper.
4. There are 17 constructed response questions. The value of each question is indicated after the question.
5. You **must show all your work for the constructed response questions**. Part values may be given for any correct work shown.
6. If you use a formula, write the formula, and show all of the substitutions you make before working out your answer using the calculator to find the answer.
7. Diagrams are not drawn to scale.

**Selected Response**

- 1) Hamish gathered the following evidence.

$$5(22) = 110$$

$$5(33) = 165$$

$$5(44) = 220$$

Which conjecture might Hamish make from this evidence? Is the conjecture reasonable?

- ☐ A. When you multiply 5 by a multiple of 11, the first and last digits of the product will sum to the middle digit; this conjecture is valid.
- ☐ B. When you multiply 11 by a multiple of 5, the first and last digits of the product will sum to the middle digit; this conjecture is valid.
- ☐ C. When you multiply 5 by a multiple of 11, the first and last digits of the product will sum to the middle digit; this conjecture is not valid.
- ☐ D. When you multiply 11 by a multiple of 5, the first and last digits of the product will sum to the middle digit; this conjecture is not valid.

- 2) What type of error, if any, occurs in the following proof?

$$2 = 2 + 2$$

$$4(2) = 4(2 + 2)$$

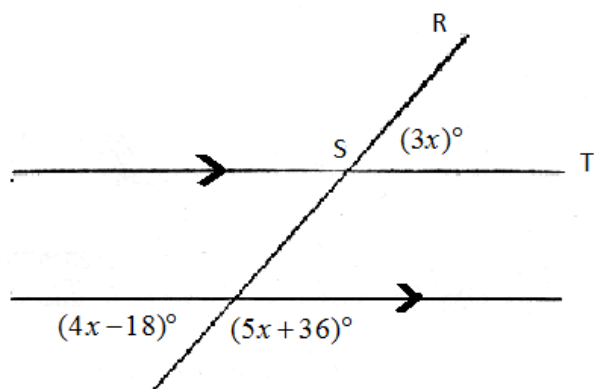
$$4(2) + 3 = 4(2 + 2) + 3$$

$$8 + 3 = 16 + 3$$

$$11 = 19$$

- |  |  |
|--|--|
| <input type="radio"/> A a false assumption or generalization | <input type="radio"/> B an error in reasoning          |
| <input type="radio"/> C an error in calculation              | <input type="radio"/> D there is no error in the proof |

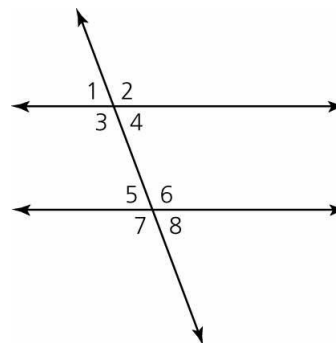
- 3) What is the measure of  $\angle RST$ ?



- |  |   |
|--|---|
| <input type="radio"/> A $m\angle RST = 18^\circ$ | <input type="radio"/> B $m\angle RST = 21^\circ$  |
| <input type="radio"/> C $m\angle RST = 54^\circ$ | <input type="radio"/> D $m\angle RST = 126^\circ$ |

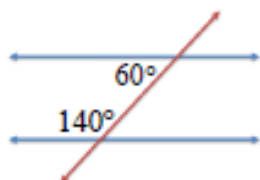
4) Angle #2 and angle #6 are

- ☐ A Corresponding angles      ☐ B Vertically opposite angles  
☐ C Alternate interior angles      ☐ D Alternate exterior angles

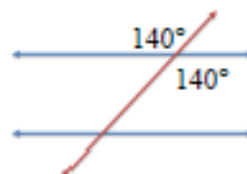


5) In which of the following diagrams can you be certain that two lines are parallel?

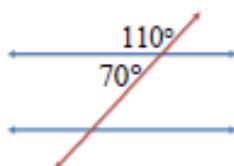
☐ A



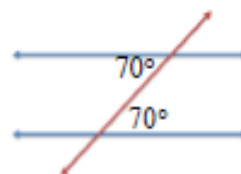
☐ B



☐ C



☐ D



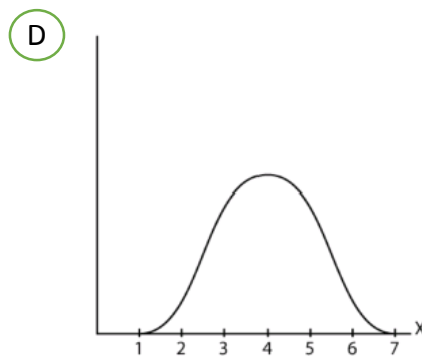
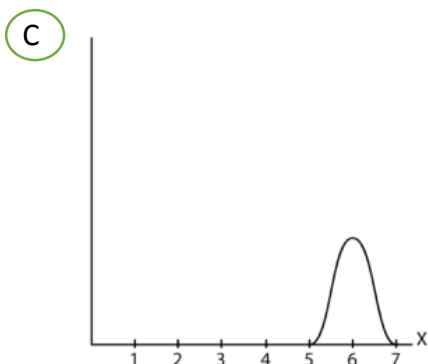
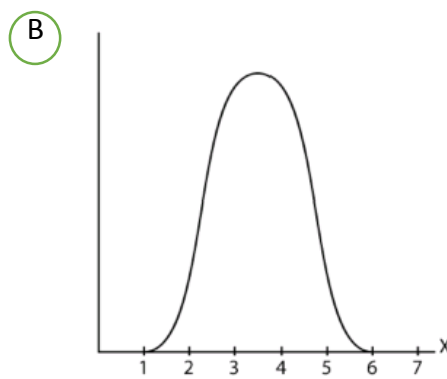
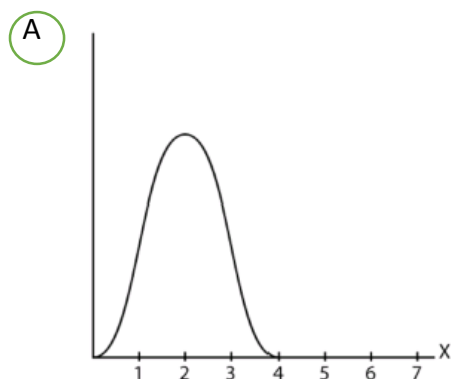
6) What is the measure of the smallest angle in a triangle with sides 12, 17, and 20?

- ☒ A  $12^\circ$       ☒ B  $36^\circ$   
☒ C  $37^\circ$       ☒ D  $58^\circ$

7) How many distinct triangles can be formed if  $m\angle A = 30^\circ$ , side  $b = 12$ , and side  $a = 8$ ?

- (A) 0                      (B) 1  
(C) 2                      (D) 3

8) Which of the following graphs of the normal distribution has the largest standard deviation?



9) Given a normally-distributed data set whose mean is 40 and whose standard deviation is 8, what value of  $x$  would have a z-score of 1.25?

- (A) 10                      (B) 20  
(C) 30                      (D) 50

10) The heights of males are normally distributed with a mean of 175 cm and a standard deviation of 20 cm. If Mario is 180 cm tall, what percent of men is he taller than?

- (A) 25.0%                      (B) 40.1%
- (C) 59.9%                      (D) 68.0%

11) The manufacturer claims that the life span of the bulb is normally distributed, with a mean of 2000 hours and standard deviation of 250 hours. When 200 light bulbs are tested how many would you expect to last between 1750 hours and 2500 hours?

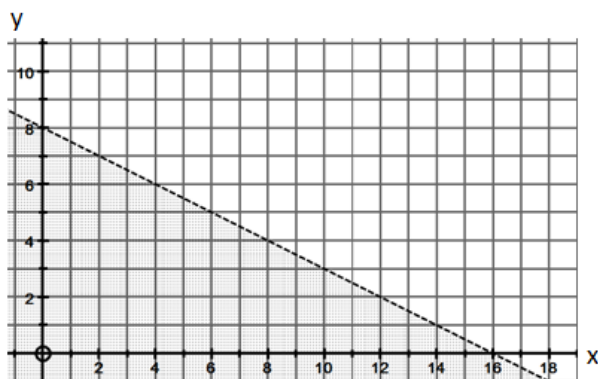
- (A) 82                              (B) 128
- (C) 163                            (D) 190

12) What fault do all these sampling designs have in common?

- I. The *Wall Street Journal* plans to make a prediction for a presidential election based on a survey of its readers.
- II. A radio talk show asks people to phone in their views on whether the United States should pay-off its huge debt to the United Nations.
- III. A police detective, interested in determining the extent of drug use by teenagers, randomly picks a sample of high school students and interviews each one about any illegal drug use by the student during the past year.

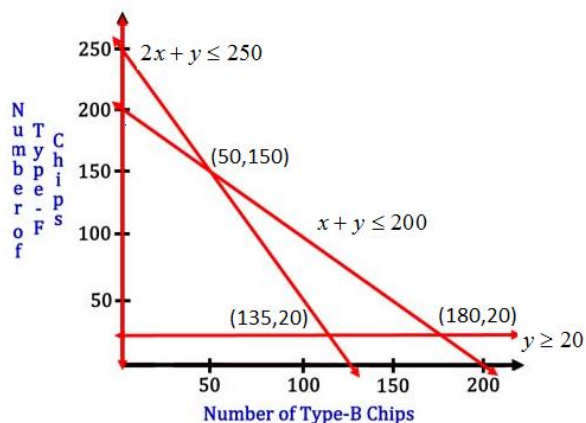
- (A) They make proper use of random sampling.
- (B) They have errors that can lead to strong bias.
- (C) They confuse *association* with *cause and effect*.
- (D) They are examples of convenience sampling.

13) Which of the following linear inequality describes the graph shown below?



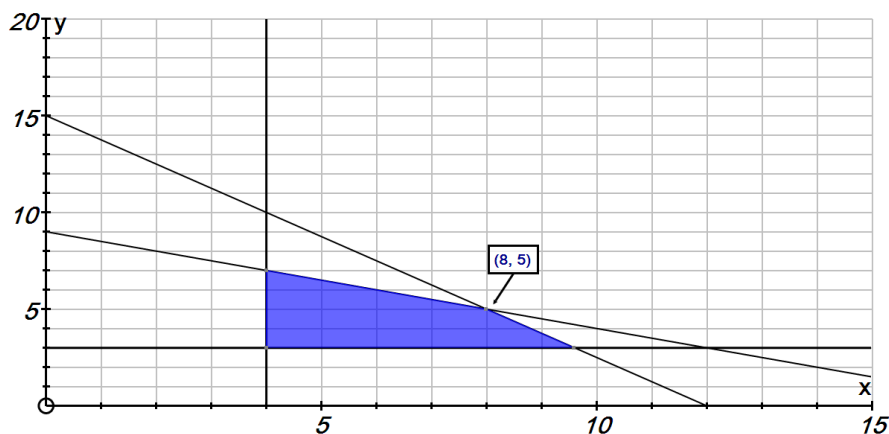
- (A)  $\left\{ (x, y) \mid y > 8 - \frac{1}{2}x, x \in W, y \in W \right\}$
- (B)  $\left\{ (x, y) \mid y < 8 - \frac{1}{2}x, x \in W, y \in W \right\}$
- (C)  $\left\{ (x, y) \mid y > 8 - \frac{1}{2}x, x \in R, y \in R \right\}$
- (D)  $\left\{ (x, y) \mid y < 8 - \frac{1}{2}x, x \in R, y \in R \right\}$

- 14) The graph shown here can be used to identify the feasible region for a manufacturer of two types of microchips. What points would be considered when determining the optimal number of each microchip that should be produced by this manufacturer?



- A. (50,150), (180,20), (135,20)  
 B. (50,150), (180,20), (135,20), (0,250)  
 C. (50,150), (180,20), (135,20), (0,200)  
 D. (50,150), (0,20), (135,20), (0,200)

- 15) What set of inequalities define the following region?



- A.  $\begin{cases} y \leq 15 - 1.25x \\ y \geq 9 - 0.5x \\ x \geq 4 \\ y \geq 3 \end{cases}$  B.  $\begin{cases} y \geq 15 - 0.8x \\ y \geq 9 - 2x \\ x \leq 4 \\ y \leq 3 \end{cases}$  C.  $\begin{cases} y \leq 15 - 0.8x \\ y \leq 9 - 2x \\ x \geq 4 \\ y \geq 3 \end{cases}$  D.  $\begin{cases} y \geq 15 - 1.25x \\ y \geq 9 - 0.5x \\ x \leq 4 \\ y \leq 3 \end{cases}$

- 16) What are the root(s) of  $f(x) = 2x^2 - 44x + 242$ ?

- A. 11 B. 2 and 11  
 C. -11 D. 242

17) What are the equation of the axis of symmetry and the coordinates of the vertex of the graph of  $y = 48 - 4x - 2x^2$ ?

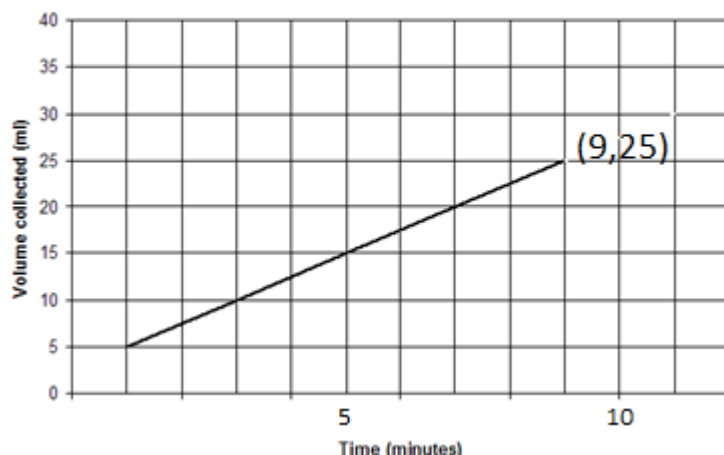
- A.  $x = 1; V(1, 21)$
- B.  $x = 1; V(1, 42)$
- C.  $x = -1; V(-1, 54)$
- D.  $x = -1; V(-1, 50)$

18) Which quadratic function has zeros of  $\frac{1}{2}$  and  $-3$ ?

- A.  $y = 2x^2 - 7x + 3$
- B.  $y = 2x^2 - 5x - 3$
- C.  $y = 2x^2 + 5x - 3$
- D.  $y = 2x^2 + 7x + 3$

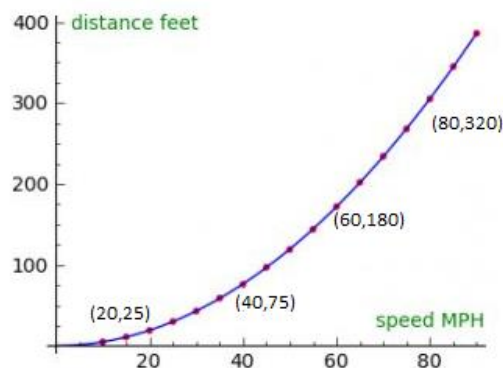
19) A water facet is leaking. Based on the graph, which of the following statements is correct?

Volume of water from a leaky faucet over time



- A. Water is leaking at a constant rate of 0.4 ml/minute.
- B. Water is leaking at a constant rate of 2.5 ml/minute.
- C. Water is leaking at a constant rate of 3 ml/minute.
- D. Water is leaking at a constant rate of 3.125 ml/minute.

- 20) What is the average rate of change,  $\frac{\Delta y}{\Delta x}$ , for the function, shown to the right, between the speeds of 40 mph and 80 mph?



- A. 0.163 feet / MPH  
 B. 4.0 feet / MPH  
 C. 4.917 feet / MPH  
 D. 6.125 feet / MPH
- 21) A room in a floor plan is 8.4 cm by 9.12 cm. The floor plan was made using a scale factor of 0.024. What are the dimensions of the actual room?
- A. 2 m by 2.19 m  
 B. 20.16 m by 21.9 m  
 C. 3.5 m by 3.8 m  
 D. 202 cm by 219 cm
- 22) A cylinder has a surface area of  $800 \text{ cm}^2$ . A second cylinder is created with all its dimensions  $\frac{3}{2}$  times those of the first cylinder. What will the surface area of this second cylinder be?
- A.  $1200 \text{ cm}^2$   
 B.  $1800 \text{ cm}^2$   
 C.  $1800\pi \text{ cm}^2$   
 D.  $2700 \text{ cm}^2$



**Constructed Response**

- 1) Prove that: if 5 is subtracted from the square of an odd number then the result is divisible by 4. (4 points)

- 2) Lauren created this step-by-step number trick:

Choose a number.

Multiply by 2.

Add 5.

Multiply by 4.

Add 30.

Subtract 18.

Divide by 4.

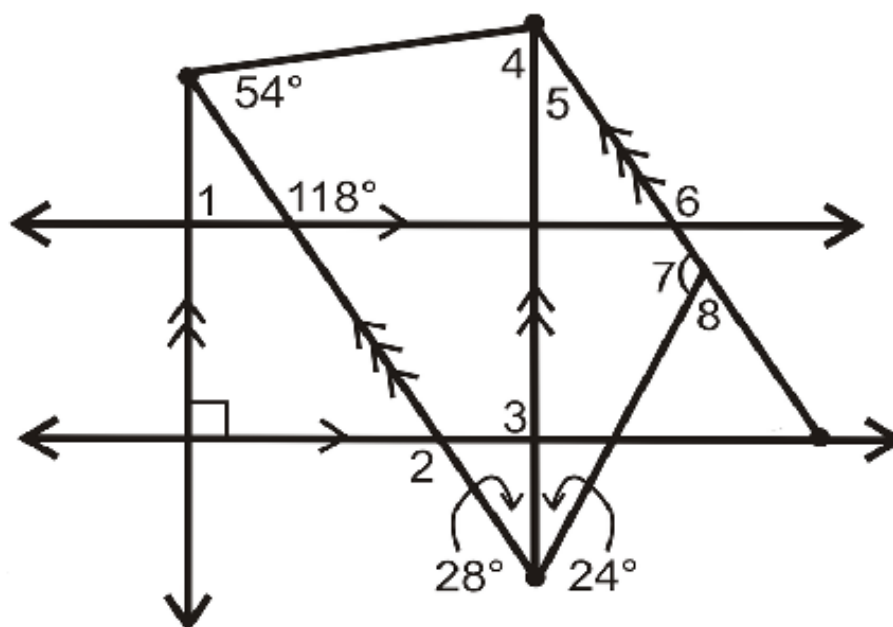
Subtract 8.

- a) Test the number trick using three different examples. What conjecture can you make based on this evidence? (2 points)

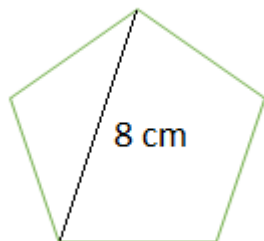
- b) Prove using deduction that this is always true. (2 points)

3) Find the size of each of the numbered angles below.

(4 points)



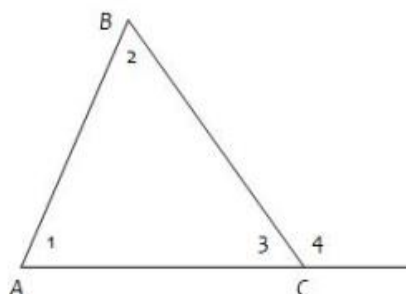
- 4) Determine the perimeter of the regular pentagon to the nearest tenth of a metre. (4 points)



- 5) Imogen stated that an exterior angle to a triangle is equal to the sum of the two non-adjacent interior angles. She proved her statement using the proof below. Fill in reasons for each of the statements that she made. (4 points)

Given:  $\triangle ABC$  with an exterior angle

Prove:  $m\angle 4 = m\angle 1 + m\angle 2$



Statements	Reasons
$m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ$	
$m\angle 3 + m\angle 4 = 180^\circ$	
$m\angle 1 + m\angle 2 + m\angle 3 = m\angle 3 + m\angle 4$	
$m\angle 1 + m\angle 2 = m\angle 4$	

6) An architect commissions a contractor to produce a triangular window. The architect describes the window as  $\triangle ABC$ , where  $m\angle A = 50^\circ$ ,  $m\angle B = 70^\circ$ , and  $AB = 12$  inches.

a) Has the architect given sufficient information for the contractor to build the window? Explain. (1 point)

b) What is the perimeter of this window, to the nearest cm? (4points)

- 7) Amiee stands in a firetower that is 40 m high.
- ⇒ When she is looking  $N63^\circ W$  she notices a fire. Her angle of depression when looking at this fire is  $12^\circ$ .
  - ⇒ When Amiee turns so she is looking  $N10^\circ E$  she notices a group of campers. Her angle of depression when looking at this group of campers is  $23^\circ$ .

How far are the campers, to the nearest metre, from the fire? (5 points)

8) Daytime speed data for a four-lane highway was collected in 2014.

- ⇒ The speed limit was 110 km/h.
- ⇒ The total number of cars travelling this highway during the past week was: 12 753.
- ⇒ The speed of these cars was normally distributed such that the mean was 106 km/h and the standard deviation was 10.5 km/h.

a) If the actual enforced speed limit is 115 km/h, determine the number of speeding tickets that could have been given out over this period of time. (3 points)

b) For a two-lane highway the speeds are also normally distributed with a mean of 85 km/h. If electronic tickets or warnings are issued to all those who are driving more than 100 km/hour and it is estimated that approximately 10% of the drivers will get tickets or warnings, what is the standard deviation of the speeds on this 2-lane highway? (3 points)

- 9) Based on a sample of 100 employees a 95% confidence interval is calculated for the mean age of all employees at a large firm.

The 95% confidence interval is from 34.5 years - 47.2 years.

a. What was the margin of error? (1 point)

b. What is the sample mean? (1 point)

c. If you wanted to report a 99% confidence interval, based on the same sample, how would you expect this to impact: (1 point)

- i) The sample mean?
- ii) The margin of error?

d. If the sample size was increased how would you expect this to impact the 95% confidence interval? (1 point)



- 10) A diet is to include at least 150 milligrams of Vitamin A and at least 145 milligrams of Vitamin B. These requirements can be obtained from two types of food. Type X contains 10 milligrams of Vitamin A and 20 milligrams of Vitamin B per pound. Type Y contains 30 milligrams of Vitamin A and 15 milligrams of Vitamin B per pound. Type X food costs \$12 per pound and type Y food costs \$8 per pound.

Use the following constraints to determine how many pounds of each type of food should be purchased to satisfy the requirements at the minimum cost? (6 points)

Constraints:

$$X \geq 0$$

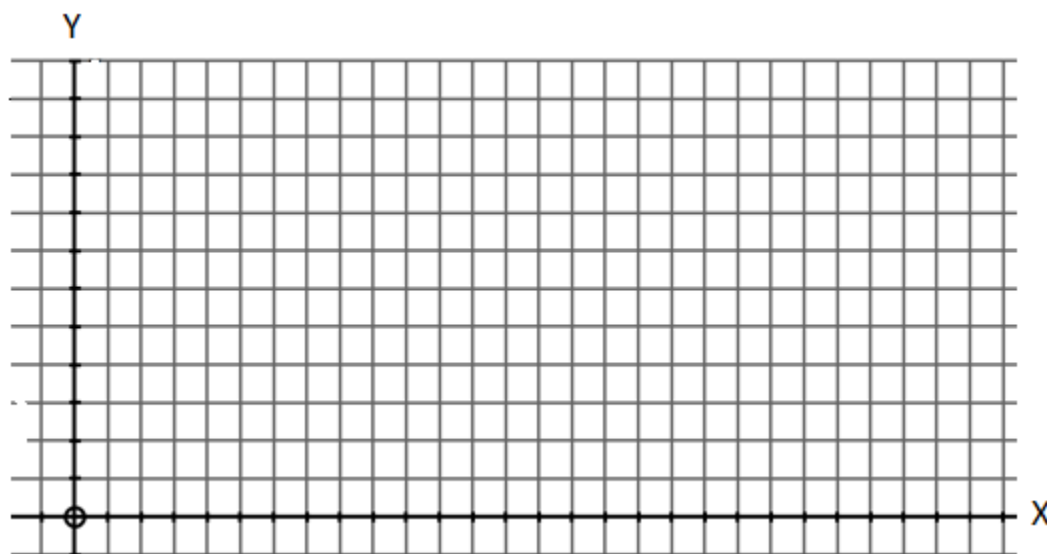
$$Y \geq 0$$

Vitamin A:

$$10X + 30Y \geq 150$$

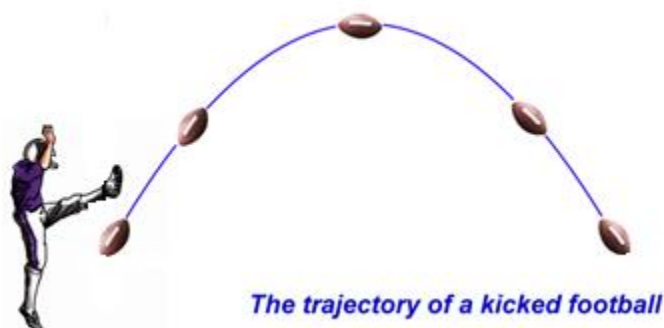
Vitamin B:

$$20X + 15Y \geq 135$$



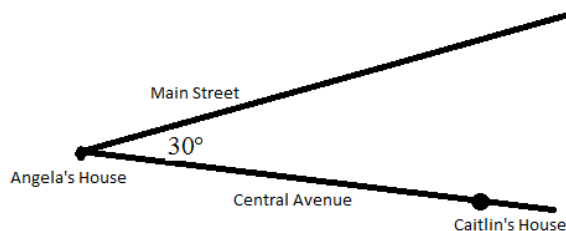
- 11) A football is kicked from a height 0.25 foot above the ground. The ball reaches a maximum height of 15.25 feet after when it has travelled a horizontal distance of 30 feet.

*Projectile Motion*



- a) What equation could be used to describe the height of the ball in terms of the horizontal distance that it has travelled? (3 points)
- b) The goal post sits 10 feet above the ground and is located 45 feet from where the ball is kicked. Is it possible that the football will clear the goal post and the team will score? Show your calculations. (3 points)

- 12) Main Street and Central Avenue intersect, making an angle measuring  $30^\circ$ . Angela lives at the intersection of the two roads, and Caitlin lives on Central Avenue 10 km from the intersection. Leticia lives on Main Street and says that her house is exactly 7 km from Caitlin's house.



- a) Since Leticia's house on Main Street what do you know about how far it is from Caitlin's house? (2 points)
- b) Leticia says that her house is 7km from Caitlin's house. Angela decided to use the law of cosines to determine just how far Leticia's house from her house. Complete her work and use the answer to determine where Leticia lives. (2 points)

$$7^2 = 10^2 + x^2 - 2(10)(x)\cos 30^\circ$$

$$49 = 100 + x^2 - 17.3x$$

$$0 = x^2 - 17.3x + 51$$

12) A frog sitting on a rock jumps into a pond. The height,  $h$ , in centimetres, of the frog above the surface of the water as a function of time,  $t$ , in seconds, since it jumped can be modelled by the function  $h(t) = -490t^2 + 980t + 1470$ .

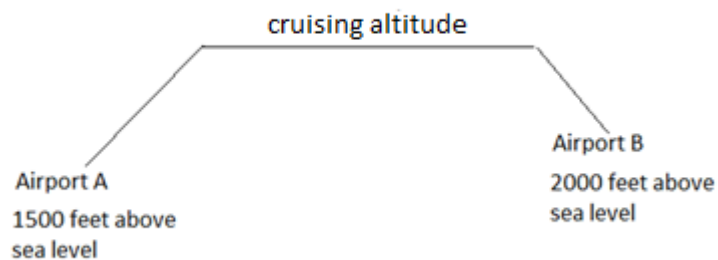
a) What is the y-intercept? What does it represent in this situation? (1 point)

b) Algebraically determine when the frog hits the surface of the water? (2 points)

c) Algebraically determine the maximum height the frog reaches? (2 points)

- 13) The roof of a tunnel is in the shape of a parabolic arch whose highest point is 18 m above a road. The road surface is 16 m wide at ground level. Lights are placed in the tunnel 12 m high. How far from the center of the tunnel are the lights placed? (6 points)

- 14) A plane leaves Airport A that is 1500 feet above sea level at 7 am. The plane climbs steadily at a rate of 80 feet/min for 16 minutes. After cruising at this altitude for 35 minutes, the plane descends steadily at a rate of 90 feet/min to Airport B that is 2000 feet above sea level. What time, to the nearest second, does the jet land? (3 points)

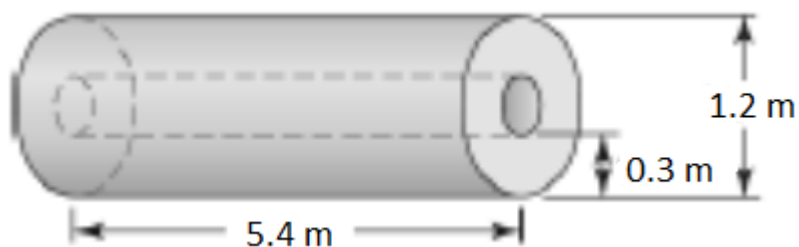


- 15) A drink was sold in a cylinder with a capacity of  $650 \text{ cm}^3$  and a surface area of  $400 \text{ cm}^2$ . In order to maintain the price of the drink while increasing profits, the manufacturer decides to reduce all the dimensions of the cylinder so that it is similar in shape but with a capacity of  $520 \text{ cm}^3$ .

Determine the surface area, to the nearest square cm, of the new cylindrical container.

(3 points)

- 16) The scale diagram below shows a pipe. The scale used to create the diagram is 1:3.  
What is the volume of the actual pipe? (3 points)



**Note:** The volume of a cylinder is found using the formula  $V = \pi r^2 h$ .