

Menihek High School

Student _____

Teacher _____

MATHEMATICS 2204

January 2010

Value: 100 marks

Time: 3 hours

General Instructions

1. Candidates are required to do **ALL** items.
2. The examination consists of the following parts:

Part I:	30 Selected Response	<i>Value: 45%</i>
Part II:	Constructed Response	<i>Value: 55%</i>
3. A self-powered calculator may be used for calculations and to obtain special values.
4. For Part II items, candidates are reminded to show all necessary steps and calculations as credit may be given for incomplete or partially correct solutions. Correct answers without calculations will not merit full marks.

Student Checklist

The items below are your responsibility. Please ensure that they are completed.

- Write your name on the top of this page.
- Write your name on the computer scorable answer sheet for Part I.
- Write your teacher's name on the top of this page.
- Check this exam to see that there are no missing pages.

**DO NOT OPEN THIS EXAMINATION PAPER UNTIL
YOU ARE TOLD BY THE SUPERVISOR TO BEGIN**

Section A
Total Value: 50%

Answer all items. Place the letter corresponding to the correct answer on the provided computer scorable answer sheet.

1. What is the solution for the system of equations below?

$$3x - y = 16$$

$$2x + y = 9$$

- (A) 5, -1
- (B) 5, 1
- (C) 7, -5
- (D) 7, 5

2. Bernard went to his local computer store and purchased 3 packs of paper and 2 ink cartridges for \$59.75. Patrick went to the same store and bought 4 packs of paper and 6 ink cartridges for \$129.50. If p represents the cost of a pack of paper and c represents the cost of an ink cartridge, which system of equations models this situation?

- (A) $2p + 3c = 59.75$
 $6p + 4c = 129.50$
- (B) $3p + 2c = 59.75$
 $4p + 6c = 129.50$
- (C) $3c + 2c = 59.75$
 $4p + 6p = 129.50$
- (D) $3p + 2p = 59.75$
 $4c + 6c = 129.50$

3. What is the inverse of $\begin{bmatrix} 2 & 6 \\ -1 & -2 \end{bmatrix}$?

- (A) $\begin{bmatrix} -1 & -3 \\ \frac{1}{2} & 1 \end{bmatrix}$
- (B) $\begin{bmatrix} -1 & -\frac{1}{2} \\ 3 & 1 \end{bmatrix}$
- (C) $\begin{bmatrix} \frac{1}{5} & \frac{1}{10} \\ -\frac{3}{5} & -\frac{1}{5} \end{bmatrix}$
- (D) $\begin{bmatrix} \frac{1}{5} & \frac{3}{5} \\ -\frac{1}{10} & -\frac{1}{5} \end{bmatrix}$

4. Which system has a solution of $(1, -2, 5)$?

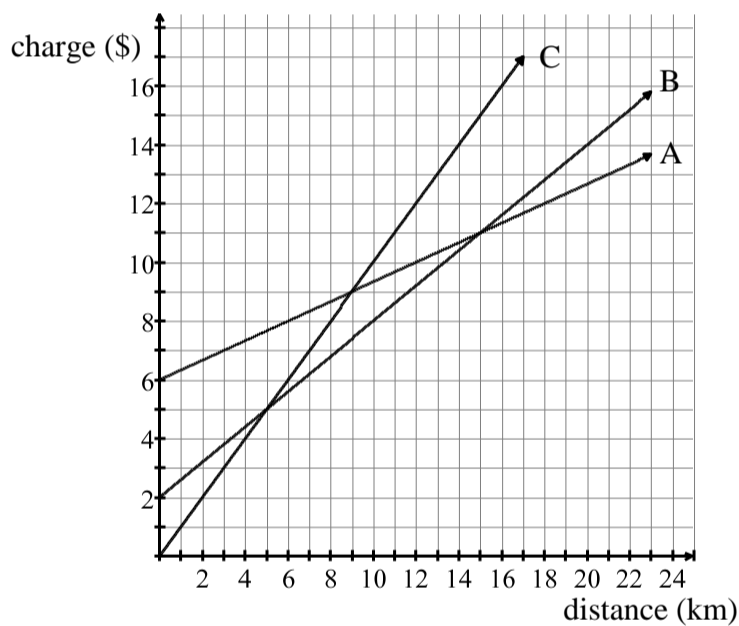
(A) $x = 1$
 $x - y = -1$
 $x + y + z = 4$

(B) $x + y = 3$
 $y = 2$
 $x - 2y + z = 2$

(C) $x + 2y - z = -8$
 $2x - z = -3$
 $z = 5$

(D) $y - z = -3$
 $y = -2$
 $x - y + z = 4$

5. The graph below shows the fee structure for 3 taxi companies in Stephenville. For what distances is it cheapest to use Company C?



- (A) less than 5 kilometres
 (B) between 5 and 15 kilometres
 (C) greater than 15 kilometres
 (D) it is never best to use Company C

6. Wade's Furniture charges a delivery fee of \$10 plus an additional \$0.75 per kilometre. Claudine's Furniture charges a delivery fee of \$5 plus an additional \$1.00 per kilometre. At what distance, in kilometres, will both companies charge the same amount?

- (A) 20
 (B) 25
 (C) 55
 (D) 60

7. A system of equations is given below:

$$\text{Equation A: } \frac{2}{3}x + y = 2$$

$$\text{Equation B: } x - \frac{4}{5}y = 1$$

If Equation A is multiplied by three and Equation B is multiplied by five, what is the sum of the two new equations?

- (A) $3x - 4y = 3$
- (B) $6x + 2y = 11$
- (C) $7x - y = 3$
- (D) $7x - y = 11$

8. Which system is equivalent to the system of equations given below?

$$3x + 5y = -11$$

$$x - y = -1$$

- (A) $-6x - 10y = -11$
 $-2x + 2y = -1$
- (B) $-6x - 10y = 22$
 $-2x + 2y = 2$
- (C) $-3x - 5y = -11$
 $-x + y = -1$
- (D) $3x - 5y = 11$
 $x + y = 1$

9. What is the matrix representation for the system of equations given below?

$$3x - 2y = 8$$

$$5y - 4z = 5$$

$$x + 8z = -9$$

(A)
$$\begin{bmatrix} 3 & -2 \\ 5 & -4 \\ 1 & 8 \end{bmatrix} \begin{bmatrix} 8 \\ 5 \\ -9 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

(B)
$$\begin{bmatrix} 3 & -2 \\ 5 & -4 \\ 1 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 5 \\ -9 \end{bmatrix}$$

(C)
$$\begin{bmatrix} 3 & -2 & 0 \\ 0 & 5 & -4 \\ 1 & 0 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 5 \\ -9 \end{bmatrix}$$

(D)
$$\begin{bmatrix} 3 & -2 & 0 \\ 5 & -4 & 0 \\ 1 & 8 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 5 \\ -9 \end{bmatrix}$$

10. What is the solution to the system of equations given below?

$$\begin{bmatrix} 2 & 5 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 14 \\ -5 \end{bmatrix}$$

- (A) $-4, 3$
- (B) $-3, 4$
- (C) $3, -4$
- (D) $4, -3$

11. If $A = \begin{bmatrix} 2 & 5 \\ -1 & 3 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, which statement is true?

- (A) $AA^{-1} = AI$
- (B) $AA^{-1} = I$
- (C) $A^{-1}I = A$
- (D) $AI = A^{-1}$

12. Dennis shoots a marble from a sling shot. The marble takes a parabolic path modeled by the equation $h = -4t^2 + 10t + 1$, where h is the height, in metres, t seconds after the marble is shot. How high, in metres, is the marble at 2 seconds?

- (A) 3
- (B) 5
- (C) 13
- (D) 29

13. Which matrix has a determinant of zero?

- (A) $\begin{bmatrix} -2 & -5 \\ -2 & -5 \end{bmatrix}$
- (B) $\begin{bmatrix} 2 & -5 \\ 2 & 5 \end{bmatrix}$
- (C) $\begin{bmatrix} 2 & 5 \\ -2 & 5 \end{bmatrix}$
- (D) $\begin{bmatrix} 2 & 5 \\ 2 & -5 \end{bmatrix}$

14. What is the solution to the system of equations represented by the matrix

multiplication $\begin{bmatrix} 2 & 3 \\ -4 & 7 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 29 \end{bmatrix}$?

(A) $\begin{bmatrix} -23 \\ -2 \end{bmatrix}$

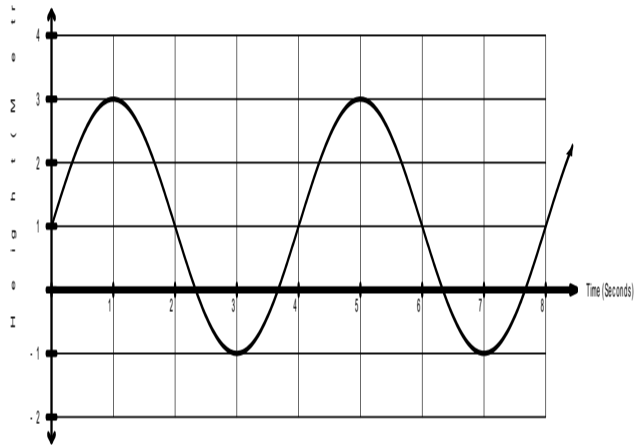
(B) $\begin{bmatrix} -16 \\ -15 \end{bmatrix}$

(C) $\begin{bmatrix} -2 \\ 3 \end{bmatrix}$

(D) $\begin{bmatrix} 97 \\ 183 \end{bmatrix}$

15. The graph below shows the height of the nail on a water wheel with respect to the water level. How many seconds does it take to make one complete revolution?

- (A) 2
- (B) 3
- (C) 4
- (D) 5

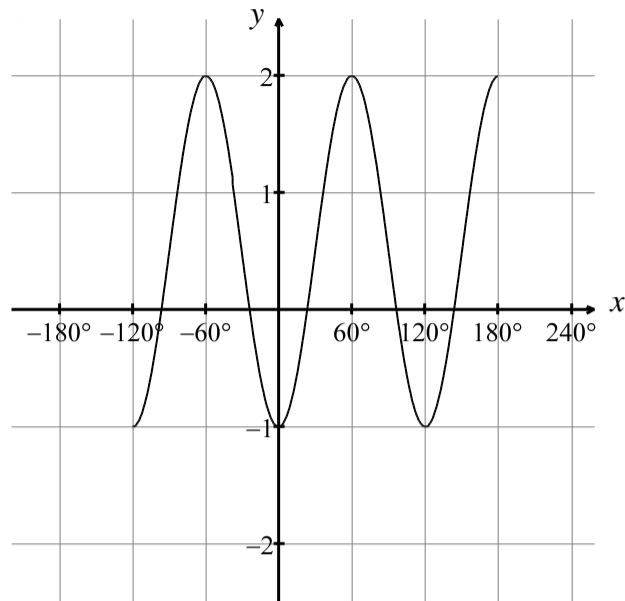


16. Which mapping rule will transform $y = \cos x$ to the relation

$$2y + 3 = \cos(x + 60^\circ) ?$$

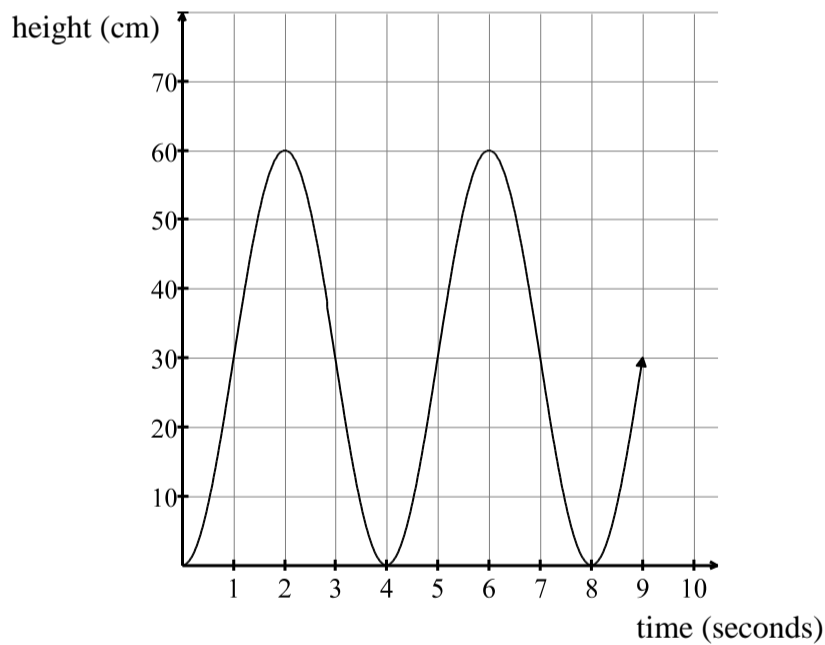
- (A) $x, y \rightarrow x - 60^\circ, -2y - 3$
- (B) $x, y \rightarrow \left(x - 60^\circ, \frac{1}{2}y - 3\right)$
- (C) $x, y \rightarrow \left(x + 60^\circ, \frac{1}{2}y + 3\right)$
- (D) $x, y \rightarrow x + 60^\circ, 2y + 3$

17. What is the range of the graph below?



- (A) $x \mid x \in \mathbb{R}$
- (B) $x \mid -120^\circ \leq x \leq 180^\circ, x \in \mathbb{R}$
- (C) $y \mid y \in \mathbb{R}$
- (D) $y \mid -1 \leq y \leq 2, y \in \mathbb{R}$

18. A pebble is stuck in a car tire. The height of the pebble varies sinusoidally with time as shown in the graph below. What is the radius, in centimetres, of the tire?



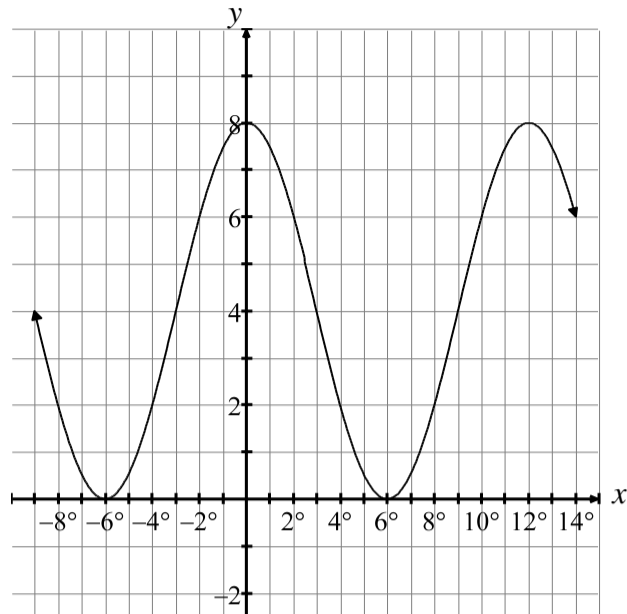
- (A) 4
- (B) 8
- (C) 30
- (D) 60

19. Given the table of values below for a sinusoidal function, what is the period of the function?

x	-45°	0°	45°	90°	135°
y	-2	1	-2	-5	-2

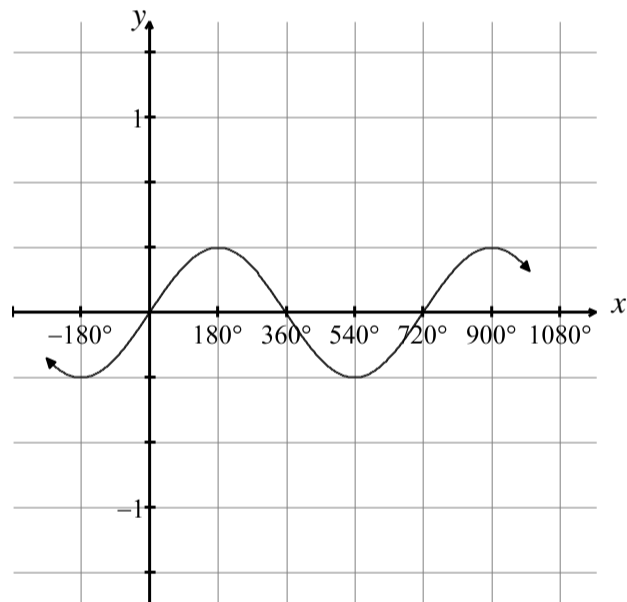
- (A) 45°
- (B) 90°
- (C) 180°
- (D) 360°

20. What is the equation of the sinusoidal axis of the function graphed below?



- (A) $y = -4$
- (B) $y = 0$
- (C) $y = 4$
- (D) $y = 8$

21. What is the equation of the sinusoidal function graphed below?

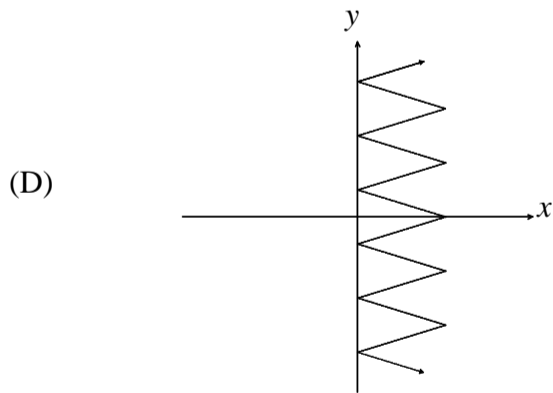
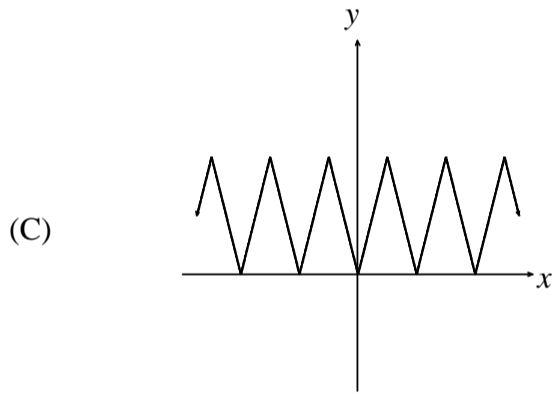
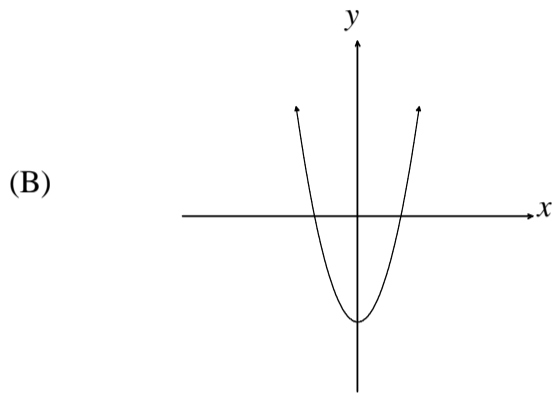
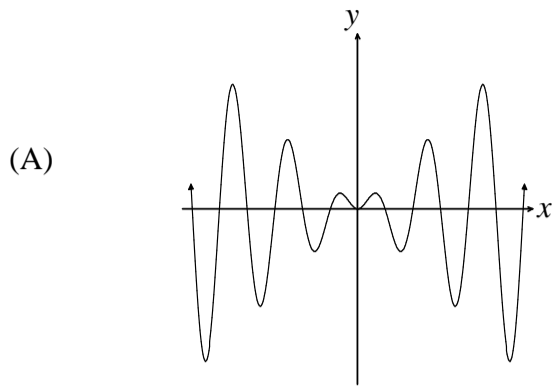


- (A) $\frac{1}{3}y = \sin\left(\frac{1}{2}x\right)$
- (B) $\frac{1}{3}y = \sin 2x$
- (C) $3y = \sin\left(\frac{1}{2}x\right)$
- (D) $3y = \sin 2x$

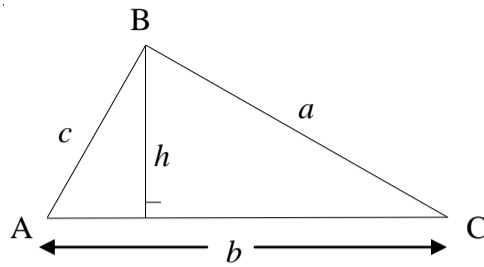
22. Which mapping rule produces an image of $y = \cos x$ with a period of 180° ?

- (A) $x, y \rightarrow \left(\frac{1}{2}x, y\right)$
- (B) $x, y \rightarrow \left(x, \frac{1}{2}y\right)$
- (C) $x, y \rightarrow x, 2y$
- (D) $x, y \rightarrow 2x, y$

23. Which graph represents a periodic function?

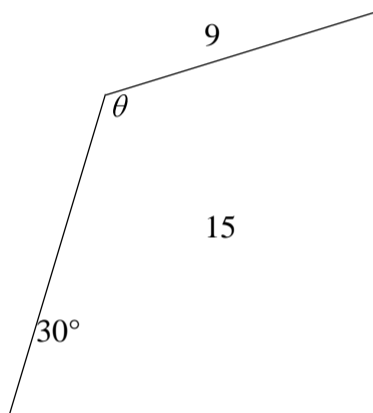


24. Which expression represents the height, h , of the triangle below?



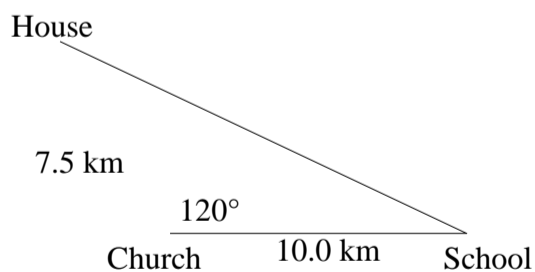
- (A) $h = a \sin A$
- (B) $h = a \sin C$
- (C) $h = b \sin A$
- (D) $h = c \sin C$

25. In the triangle below, Charlie solved for θ and got an answer of 56.4° . Her teacher said she almost had the correct answer and reminded her that θ is an obtuse angle. What is the correct answer?



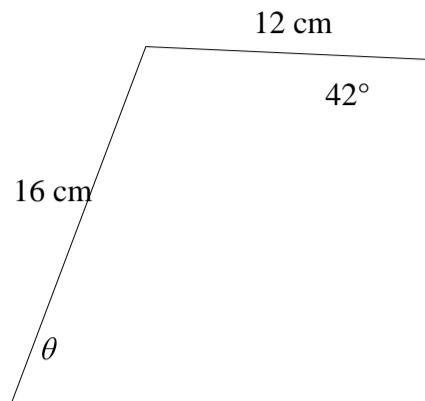
- (A) 33.6°
- (B) 123.6°
- (C) 236.4°
- (D) 303.6°

26. According to the diagram below, what is the distance, in kilometres, from the house to the school?



- (A) 9.0
- (B) 15.2
- (C) 81.3
- (D) 231.3

27. What is the measure of θ in the triangle below?



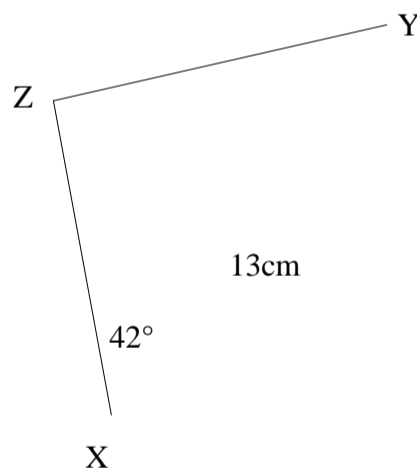
- (A) 30.1°
- (B) 36.9°
- (C) 48.6°
- (D) 63.1°

28. In $\triangle ABC$, $AC = 14.2$ cm, $BC = 16.3$ cm and $\angle C = 33^\circ$. What is the area of the triangle, in cm^2 ?

- (A) 63.0
- (B) 97.1
- (C) 126.1
- (D) 194.1

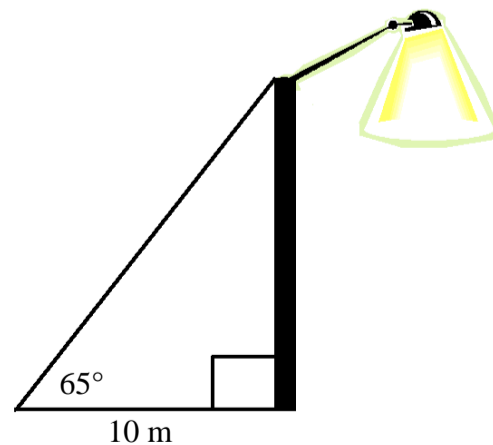
29. In the triangle below, $XY = 13$ cm, $\angle X = 42^\circ$, and the area is 79 cm^2 . What is the length of XZ , in centimetres?

- (A) 8.2
- (B) 9.1
- (C) 16.4
- (D) 18.2



30. A light pole has a support wire attached to its top. The wire is attached to the ground 10 m away and makes a 65° with the ground. If the pole makes a 90° with the ground, what is the length of the wire, in metres?

- (A) 4.2
- (B) 4.7
- (C) 21.4
- (D) 23.7



SECTION B
Total Value: 50%

Answer ALL items in the space provided. Show ALL workings.

31. Solve the following system of equations using either substitution or elimination:

$$x + y + 2z = 0$$

$$3x + 2y - z = 13$$

$$x - 2y + z = -1$$

(8%)

32. Barry's Bakery sells cookies and muffins. One customer orders 5 muffins and 8 cookies, and is charged \$17.50. Another customer orders 3 muffins and 5 cookies, and is charged \$10.75. Create a system of equations to represent this information and, using matrices, find the price of each item.

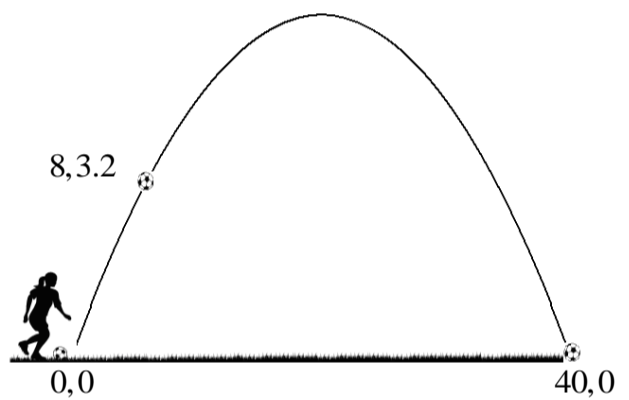
(6%)

33. A jeweler wants to make 1600 g of 25% silver compound by mixing 20% and 40% silver compounds together. How many grams of each kind will she need?

(5%)

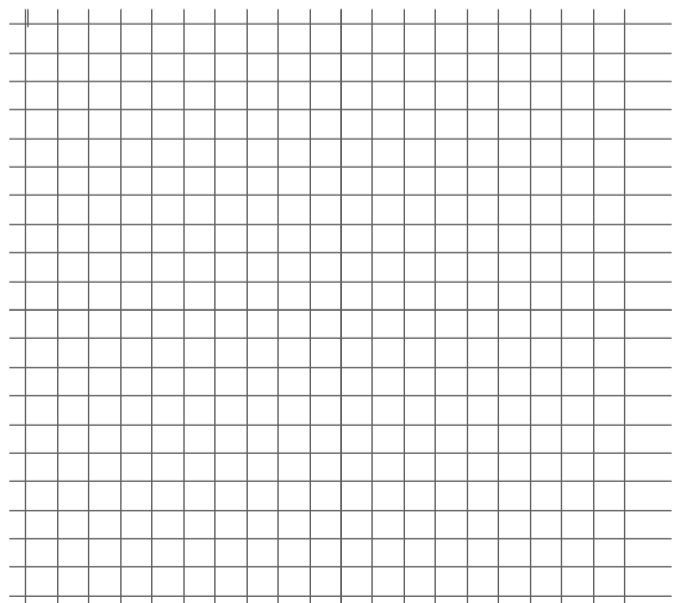
33. Amy kicked a soccer ball. After the ball travelled a distance of 8 metres, it was at a height of 3.2 metres. When the ball hit the ground, it was 40 metres away from Amy. Set up and solve a system of equations to determine the quadratic function that models the path of the soccer ball.

(6%)



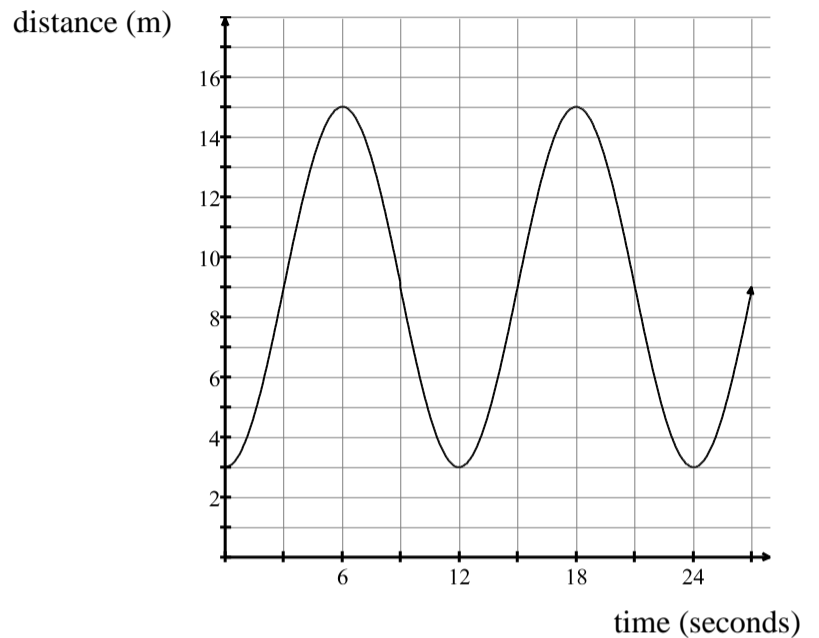
34. Graph the following relation: $-\frac{1}{2}y + 1 = \sin 3x - 90^\circ$

(5%)



35. A mother puts her child on a Merry-Go-Round. To watch her child, she stands at a point that is initially 3 metres away from the child, which is the closest distance between the mother and child. At 6 seconds, the child is 15 metres from his mother, which is the farthest distance between the mother and child. Assuming the distance between the mother and child varies sinusoidally with time, determine the relation that models this situation. Use $y = \cos(x)$ as the base function.

(5%)

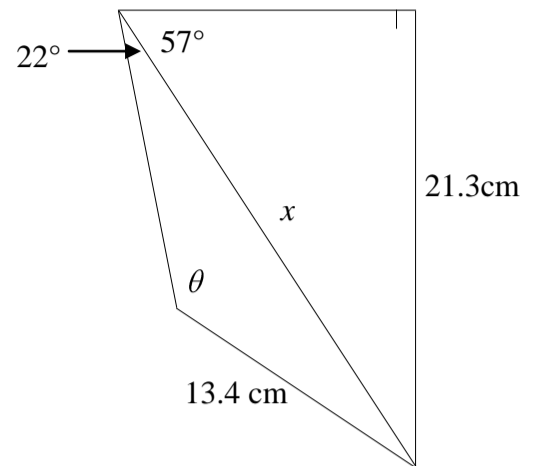


36. Jill is riding on a Ferris wheel that is spinning around at a constant speed. At $t = 6$ s, Jill is at the maximum height of 20 m above the ground and at $t = 14$ s, she is at the minimum height of 2 m above the ground. Determine the equation of the sinusoidal function that describes Jill's height above the ground with respect to time. Use $y = \sin(x)$ as the base function.

(5%)

37. Algebraically determine the measure of θ given that θ is obtuse.

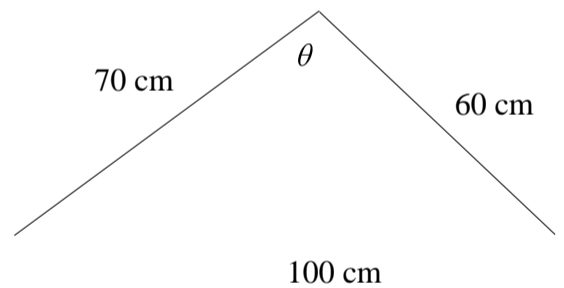
(7%)



38. A triangular sign needs to be painted. The sides measure 60 cm, 70 cm, and 100 cm.

(A) Determine the value of θ .

(4%)



(B) Find the area of the triangle.

(3%)

(C) If a can of paint costs \$7.50 and a can of paint cover 520 cm^2 , determine the cost to paint the sign assuming you must purchase entire cans (no partial cans).

(1%)