

Menihek High School January 2011

STUDENT'S NAME \_\_\_\_\_

TEACHER'S NAME \_\_\_\_\_

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

**MIDTERM EXAMINATION**  
**MATHEMATICS 2205**

Value: 100 Marks

Time: 3 hours

***General Instructions***

1. Students are required to do **ALL** items.
2. The examination consists of the following parts:  
**PART I:** Selected Response Value: 30%  
**PART II:** Constructed Response Value: 70%
3. Scientific and graphing calculators may be used.
4. Answers to **PART I** items are to be shaded on the computer scorable answer sheet. If a second sheet is provided for **PART I** items, letters should be clearly written and this sheet ***stapled to the front*** of the examination paper.
5. For **PART II** items, students are reminded to show all necessary steps and calculations as credit may be given for incomplete or for partially correct solutions. Correct answers without calculations will not merit full marks.

***Student Checklist***

***The following items are your responsibility. Please ensure that they are completed.***

- Check that you are doing the correct exam.
- Write your name on the top of this page and on any answer sheet.
- Check that the bubble sheet is adequately shaded.
- Check this exam to ensure that there are no missing pages.
- At the end of the examination period check that you have completed or at least attempted **ALL** items.

Student's Name: \_\_\_\_\_

Teacher's Name: \_\_\_\_\_

### Teacher Grading Sheet (PART I)

- |     |       |     |       |
|-----|-------|-----|-------|
| 1.  | _____ | 26. | _____ |
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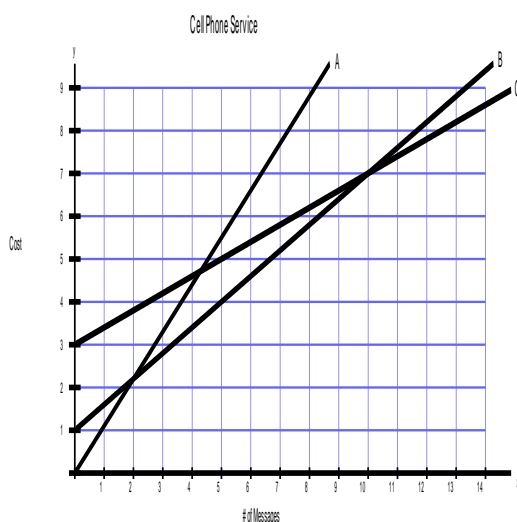
**Part 1**  
Total Value: 50%

Answer all items. Shade the letter of the correct answer on the computer scorable answer sheet.

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

$$\begin{aligned} -6x + y &= -13 \\ 4x + y &= 7 \end{aligned}$$

- (A) (2, -1)  
(B) (3, -5)  
(C) (10, 33)  
(D) (10, 47)
2. Jason and Renee went to Wal-Mart. Jason purchased 2 T-shirts and 3 pairs of socks for \$26.95. Renee bought 4 T-shirts and 5 pairs of socks for \$50.91. If  $t$  represents the cost of a T-shirt and  $s$  represents the cost of a pair of socks, which system of equations models this situation?
- (A)  $2t + 3s = 26.95$   
 $4t + 5s = 50.91$
- (B)  $3t + 2s = 26.95$   
 $5t + 4s = 50.91$
- (C)  $2t + 3t = 26.95$   
 $4s + 5s = 50.91$
- (D)  $2s + 3s = 26.95$   
 $4t + 5t = 50.91$
3. The graph shows the fee structure for text messaging for 3 cell phone service providers. For which number of messages is it cheapest to use Company B?



- (A) Less than 2 messages  
(B) Between 2 and 10 messages  
(C) Greater than 10 messages  
(D) It is never best to use Company B.

4. Reid Taxi charges a flat rate of \$3 and \$0.50 per kilometre. O'Neill Taxi charges a flat rate of \$2 and \$0.75 per kilometre. At what distance, in kilometres, will both companies charge the same amount?

- (A) 0.25  
(B) 0.8  
(C) 4  
(D) 20

5. Which matrix has **NO** inverse?

- (A)  $\begin{bmatrix} 1 & 3 \\ 2 & 2 \end{bmatrix}$   
(B)  $\begin{bmatrix} 2 & -3 \\ -2 & 3 \end{bmatrix}$   
(C)  $\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$   
(D)  $\begin{bmatrix} 4 & 2 \\ -2 & 1 \end{bmatrix}$

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

$$\begin{aligned} 7y - 3z &= 12 \\ 5x + 4y &= 16 \\ x - 13z &= -9 \end{aligned}$$

(A)  $\begin{bmatrix} 7 & -3 \\ 5 & 4 \\ 1 & -13 \end{bmatrix} \begin{bmatrix} 12 \\ 16 \\ -9 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

(B)  $\begin{bmatrix} 7 & -3 \\ 5 & 4 \\ 1 & -13 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 12 \\ 16 \\ -9 \end{bmatrix}$

(C)  $\begin{bmatrix} 0 & 7 & -3 \\ 5 & 4 & 0 \\ 1 & 0 & -13 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 12 \\ 16 \\ -9 \end{bmatrix}$

(D)  $\begin{bmatrix} 0 & 7 & -3 \\ 5 & 4 & 0 \\ 1 & 0 & -13 \end{bmatrix} \begin{bmatrix} 12 \\ 16 \\ -9 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

7. What is the solution to the matrix equation given below?

$$\begin{bmatrix} 1 & 1 & 2 \\ 4 & -2 & 2 \\ 3 & 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -3 \\ -6 \\ 10 \end{bmatrix}$$

- (A)  $(-1, -4, 1)$
- (B)  $(1, 2, -3)$
- (C)  $(2, 7, -6)$
- (D)  $(5, 2, -5)$

8. What is the inverse of  $\begin{bmatrix} 1 & 1 \\ -5 & -7 \end{bmatrix}$ ?

(A)  $\begin{bmatrix} -\frac{1}{12} & \frac{5}{12} \\ -\frac{1}{12} & \frac{7}{12} \end{bmatrix}$

(B)  $\begin{bmatrix} \frac{7}{12} & -\frac{1}{12} \\ \frac{5}{12} & -\frac{1}{12} \end{bmatrix}$

(C)  $\begin{bmatrix} \frac{7}{2} & -\frac{5}{2} \\ \frac{1}{2} & -\frac{1}{2} \end{bmatrix}$

(D)  $\begin{bmatrix} \frac{7}{2} & \frac{1}{2} \\ -\frac{5}{2} & -\frac{1}{2} \end{bmatrix}$

9. Which system of equations has the solution  $(5, 1, -2)$ ?

(A)  $x = 5$   
 $y + z = -1$   
 $x + y + z = 4$

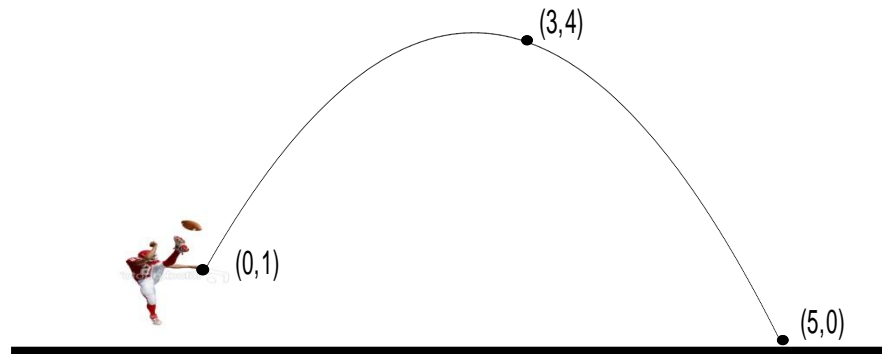
(B)  $x + y = 6$   
 $y = 1$   
 $x + y - z = 18$

(C)  $2x + z = 8$   
 $2x + y + z = 17$   
 $z = -2$

(D)  $x + y = 6$   
 $y + z = 3$   
 $x + y + z = 4$

10. The graph below represents the path of a football, in metres. What is the value of “ $c$ ” in the quadratic equation  $y = ax^2 + bx + c$  that describes the path of the ball?

- (A) 0  
(B) 1  
(C) 4  
(D) 5



11. Which system is equivalent to the following system of equations?

$$\begin{aligned}\frac{5}{2}x + \frac{3}{2}y &= 7 \\ x - \frac{1}{2}y &= 5\end{aligned}$$

- (A)  $-5x - 3y = 14$   
 $-2x + y = 10$
- (B)  $5x + 3y = 14$   
 $6x - 3y = -30$
- (C)  $10x + 6y = 14$   
 $4x - 2y = 10$
- (D)  $10x + 6y = 28$   
 $10x - 5y = 50$

12. If  $[A] = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$  and  $[I] = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$  then what is  $[A] \times [I]$ ?

- (A)  $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$
- (B)  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- (C)  $\begin{bmatrix} 2 & 2 \\ 3 & 5 \end{bmatrix}$
- (D)  $\begin{bmatrix} 0 & 2 \\ 3 & 3 \end{bmatrix}$

13. Which procedure would help you solve the system using elimination?

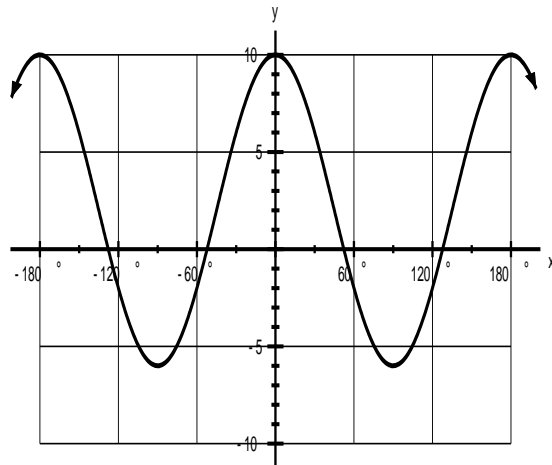
$$\text{Equation X: } 4m + 8n = 20$$

$$\text{Equation Y: } 12m + 2n = 5$$

- (A) Multiply Equation X by 4 then add to Equation Y.  
 (B) Multiply Equation X by  $-4$  then add to Equation Y.  
 (C) Multiply Equation Y by 4 then add to Equation X.  
 (D) Multiply Equation Y by  $-4$  then add to Equation X.

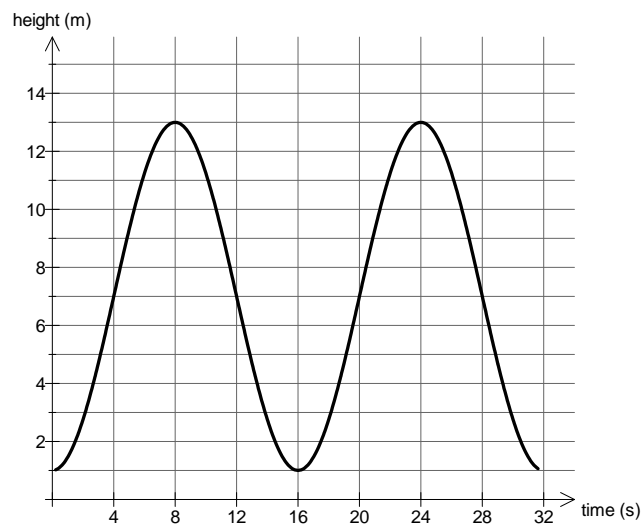
14. What is the range of the graph below?

- (A)  $\{x \mid -10 \leq x \leq 10, x \in \mathbb{R}\}$   
 (B)  $\{x \mid -10 < x < 10, x \in \mathbb{R}\}$   
 (C)  $\{y \mid -6 \leq y \leq 10, y \in \mathbb{R}\}$   
 (D)  $\{y \mid -6 < y < 10, y \in \mathbb{R}\}$



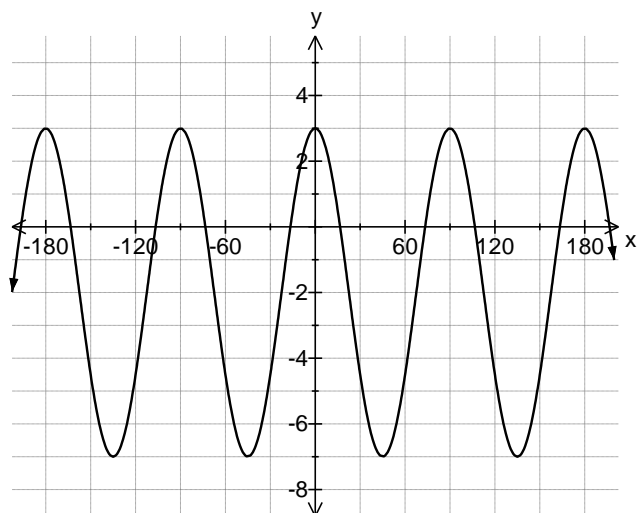
15. Reuben is riding on a Ferris wheel. The graph of his height,  $h$ , above ground at time,  $t$ , is shown. How many seconds does it take to complete **two** revolutions?

- (A) 8  
 (B) 16  
 (C) 24  
 (D) 32

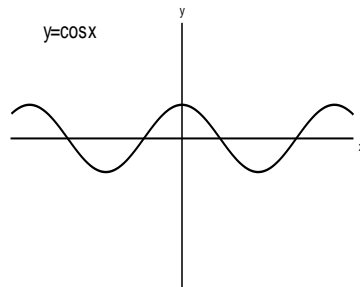


16. What is the equation of the sinusoidal axis of the function graphed below?

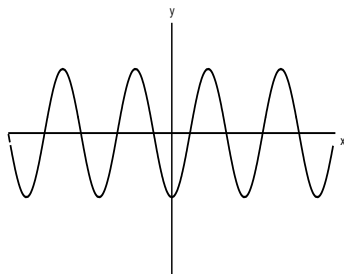
- (A)  $y = -7$   
 (B)  $y = -2$   
 (C)  $y = 2$   
 (D)  $y = 3$



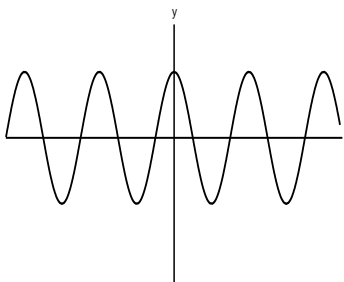
17. A sinusoidal function of the form  $\frac{1}{A}y = \cos \frac{1}{B}x$  is graphed such that  $A < -1$  and  $0 < B < 1$ . The graph for  $y = \cos x$  is provided below for comparison. Assuming all graphs have the same horizontal and vertical scales, which graph represents the function?



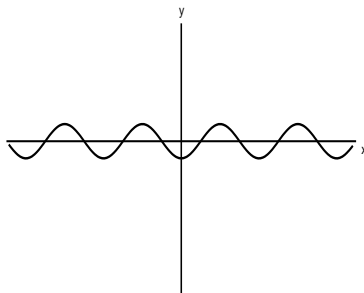
(A)



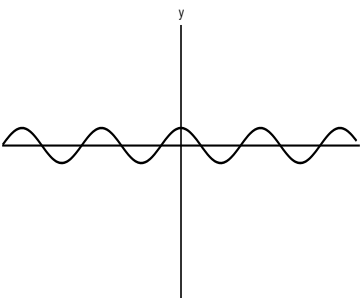
(B)



(C)



(D)

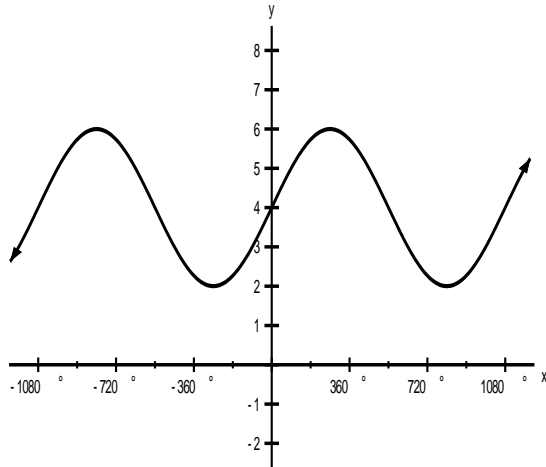


18. What is the minimum value of the function  $\frac{1}{4}(y - 3) = \sin 2(x + 30^\circ)$ ?

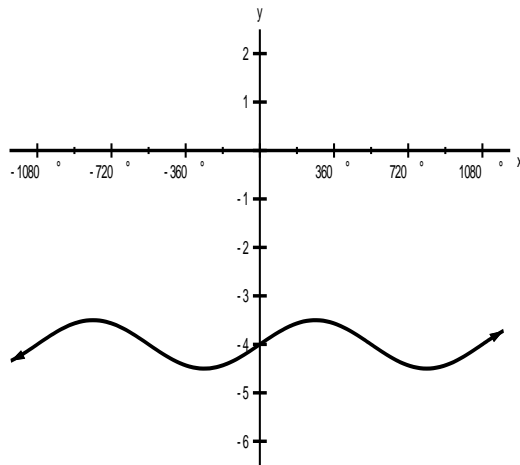
- (A) -7  
 (B) -1  
 (C) 1  
 (D) 7

19. Which graph represents the equation  $\frac{1}{2}(y + 4) = \sin(3x)$  ?

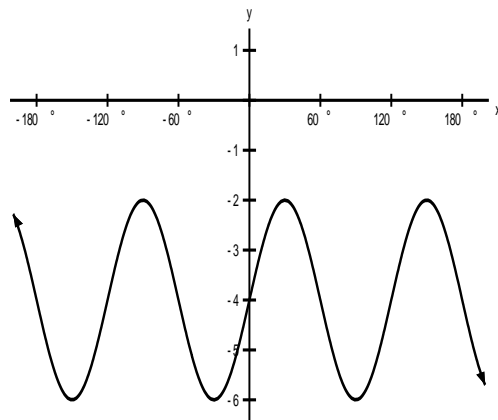
(A)



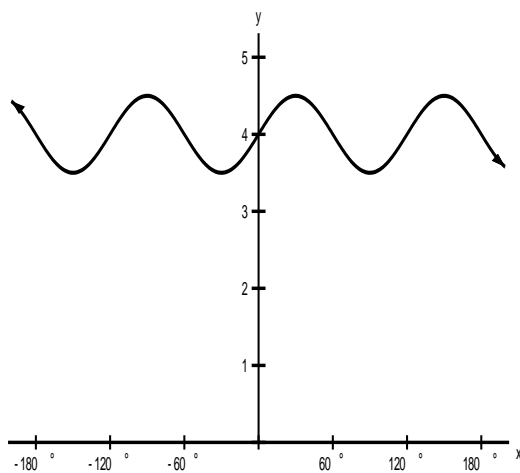
(B)



(C)



(D)



20. Which equation describes the transformation of  $y = \sin(x)$ , with the following characteristics?

- Amplitude of 3
- Sinusoidal axis of  $y = -5$
- Horizontal stretch of  $\frac{1}{6}$
- Horizontal Translation of  $45^\circ$  to the left

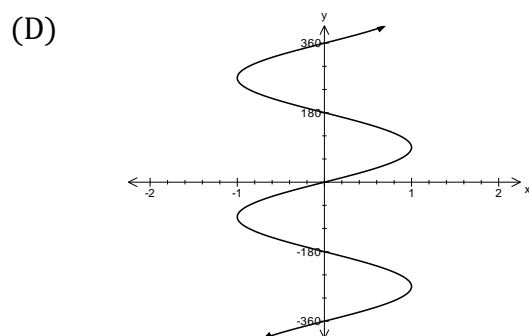
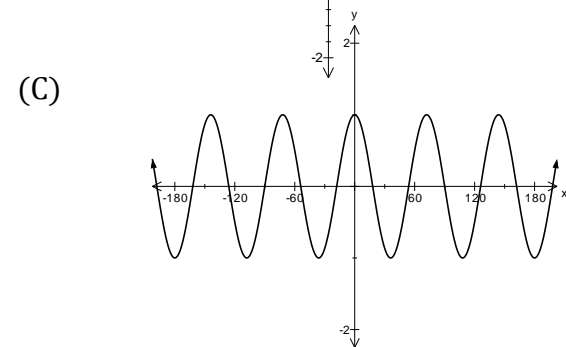
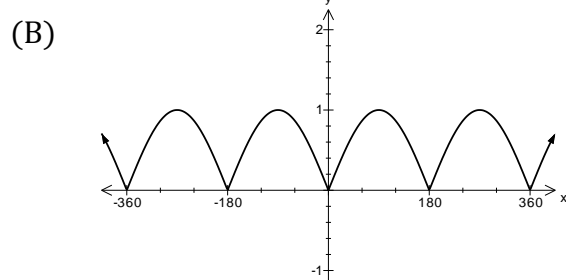
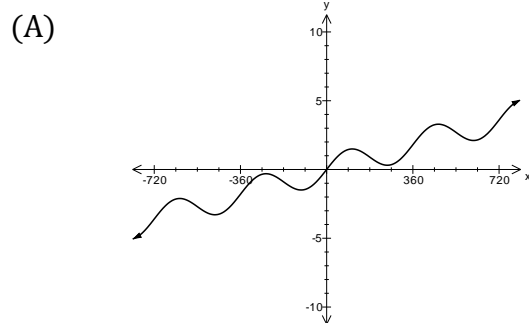
(A)  $\frac{1}{3}(y + 5) = \sin 6(x - 45)$

(B)  $\frac{1}{3}(y + 5) = \sin 6(x + 45)$

(C)  $3(y + 5) = \sin \frac{1}{6}(x - 45)$

(D)  $3(y + 5) = \sin \frac{1}{6}(x + 45)$

21. Which graph is periodic, but **NOT** sinusoidal?



22. What is the value of  $\sqrt{20} - \frac{4}{3}\sqrt{5}$ ?

- A)  $\frac{-2}{3}\sqrt{5}$       B)  $\sqrt{5}$       C)  $\frac{-8}{3}\sqrt{5}$       D)  $\frac{2\sqrt{5}}{3}$

- 23 What is the exact value of  $\frac{3\sqrt{12}}{7-\sqrt{5}}$ ?
- A)  $\frac{21\sqrt{3}+3\sqrt{15}}{44}$     B)  $\frac{21\sqrt{3}+3\sqrt{15}}{22}$     C)  $\frac{36\sqrt{2}}{11}$     D)  $\frac{24\sqrt{45}}{11}$
- 24 What is the product of  $(12 - 8\sqrt{3})(12 + 8\sqrt{3})$ ?
- A) -168    B) -48    C) 48    D) 336
- 25 What is the exact value of  $(4 + 7\sqrt{2})^2$ ?
- A) -82    B) 114    C)  $(114 + 56\sqrt{2})$     D)  $(16 + 49\sqrt{2})$
- 26 Which angle is co-terminal with  $585^\circ$ ?
- (A)  $-315^\circ$   
(B)  $-225^\circ$   
(C)  $135^\circ$   
(D)  $225^\circ$
- 27 What is the reference angle for  $-600^\circ$ ?
- (A)  $80^\circ$     (B)  $90^\circ$     (C)  $110^\circ$     (D)  $120^\circ$
- 28 In which quadrants does the terminal arm of an angle lie if the tangent and cosine ratios are both negative?
- A) 1    B) 2    C) 3    D) 4
- 29 What is the exact value of  $\cos 120^\circ + \sin 30^\circ$ ?
- (A) -4  
(B) 0  
(C) 1  
(D) 4

- 30 Solve for all values of  $x$ :  $\sqrt{2}\cos x - 4 = -5$ ,  $0^\circ < x < 360^\circ$
- A)  $45^\circ$  and  $135^\circ$
- B)  $135^\circ$
- C)  $135^\circ$  and  $225^\circ$
- D)  $225^\circ$  and  $315^\circ$

Part II

- 1 Solve algebraically. 7%

$$\begin{aligned}x + y - z &= 0 \\ \frac{1}{2}x + y + z &= 11 \\ 2x - y + \frac{1}{3}z &= 2\end{aligned}$$

- 2 A 25% vinegar solution is mixed with a 50% vinegar solution to create 200 mL of 35% vinegar solution. Set up a system of 2x2 equations and determine algebraically how many mL of each solution should be used? 5%

- 3 The student council at Menihek High School is preparing to order school T-shirts. The president knows that if the T-shirt prices are too high, fewer people will purchase them. A survey conducted by the student council confirmed this as shown in the table below.

<b>Price</b>	\$6	\$8	\$10	\$12
<b>Sales</b>	3000	3200	3000	2400

- (A) Find a quadratic function of the form  $y = ax^2 + bx + c$  relating the sales,  $y$ , to the purchase price,  $x$ . 7%
- (B) Use the function to predict the sales for a T-shirt price of \$7.50. 1%
- 4 A soccer ball is kicked from ground level. Its path can be described by the parabolic function  $H(t) = at^2 + bt + c$  where  $t$  is time in seconds and  $H(t)$  is the height of the ball in feet. It takes 3 seconds for the ball to hit the ground after it was kicked. The ball was at a height of 9.8 m after 1 second. Using matrix equations determine the quadratic function that models this situation and use it to determine the height of the ball after 2 seconds. 7%
- 5 Graph the following relation with its base graph on the graph paper provided below. 15%

$$-\frac{1}{2}(y + 3) = \sin(3x + 135^\circ)$$

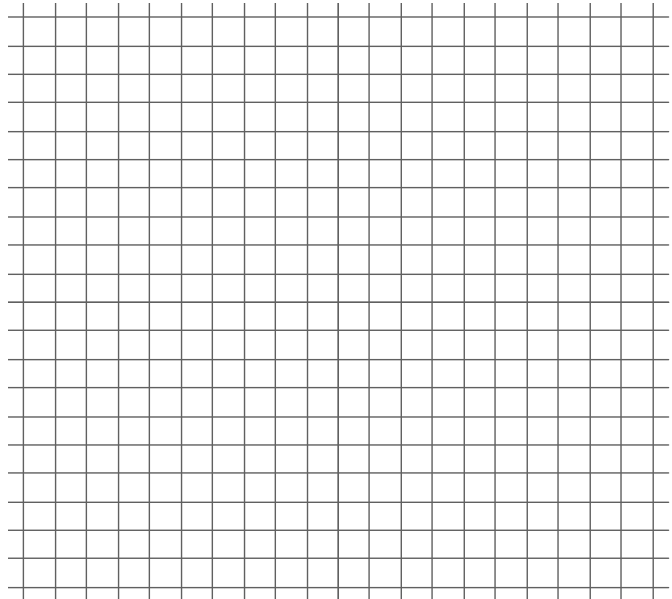
Be sure to state the following

- A) Mapping rule B) HT C) VT D) HS E) VSF

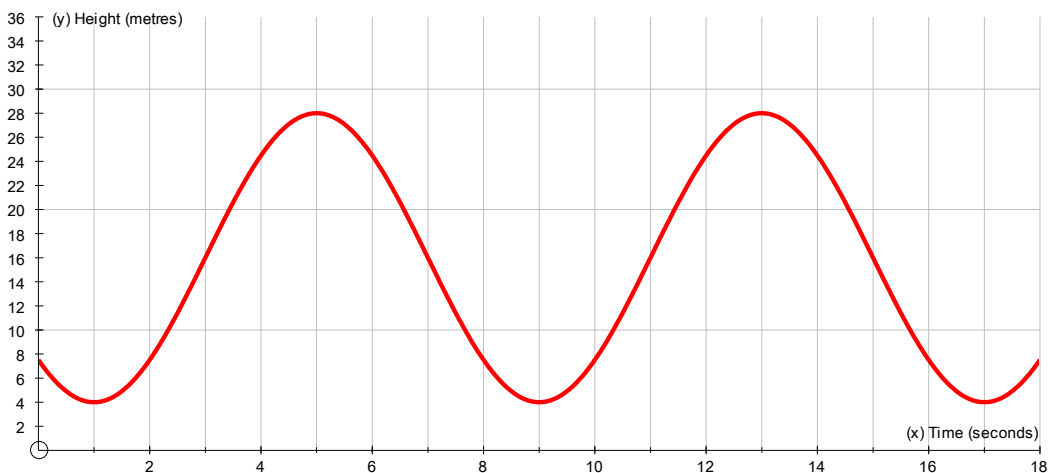
B) Period=

C) Range:

D) Tables with the base graph showing one full period.



- 6 The graph below showing the revolution of a Ferris wheel with respect to height of a person in a chair versus time. Determine an equation as a **reflection** of the transformation of  $y = \cos x$  in transformational and functional form. Use your function to determine the height of the wheel at 38s. 5%



- 7 A large tire on a 966 production loader in Wabush Mines has a diameter of 4 m. One tire had to be removed to a local company GSC who repair patches in these industrial tires. The patch is quite noticeable when the work is completed. If the patch is at its maximum height when the loader was beginning to move, sketch a graph of the height of the patch versus the distance the tire as rolled. Find the equation of the graph as a transformation of the sine wave in functional form using exact values only.

5%

- 8 Determine the exact value of the expressions below.

A)  $\frac{3\sqrt{8}-16\sqrt{6}}{4+8\sqrt{24}}$  6%

B)  $\frac{\sin(-60^\circ)}{\cos(30^\circ)+\sin(225^\circ)}$  6%

9 Solve for all values of x algebraically:  $2 \cos(x) - 5 + \sqrt{3} = -5$  6%

End