

Name: Solutions

Teacher: ORAM

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

# Mathematics 3201

## PRE-PUBLIC EXAMINATION

JUNE 2015

Value: 100 Marks

Duration: 3 Hours

### General Instructions

This examination consists of two parts. Part I of the exam consists of selected response questions and Part II consists of constructed response questions.

#### Selected Response (50 marks)

Select the letter of the correct response from those provided. Place the CAPITAL LETTER of the correct response in the blank space provided on your Selected Response Answer Sheet.

#### Constructed Response (50 marks)

Answer ALL questions fully and concisely in the space provided. Show all work.

#### Student Checklist

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

- Write your name and teacher's name on the top of this page.
- Write your name, teacher's name, course name and number on the Selected Response Answer Sheet.
- Check the exam to ensure there are no missing pages. There are 24 pages in total.

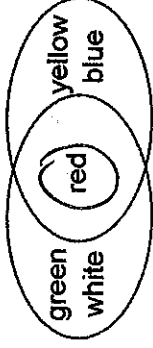
**ALL MATERIALS MUST BE PASSED IN WITH THIS EXAM. Use your time wisely. Good luck!**

PART I

Total Value: 50 marks

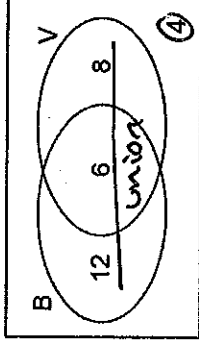
Answer all items. Place the CAPITAL LETTER of the correct answer on the answer sheet provided.

1. Given the Venn Diagram, what elements are in the intersection of A and B,  $A \cap B$ ?



- (A) {red}  
 (B) {green, white}  
 (C) {yellow, blue}  
 (D) {green, white, red, yellow, blue}

2. There are 30 students in Grade 12. The number of students on the basketball team and the volleyball team are shown in the Venn Diagram. Determine the number of students in the complement of the union of the sets B and V,  $n(B \cup V)'$ .



- (A) 4  
 (B) 6  
 (C) 20  
 (D) 26

3. Given the following sets, which statement is true?

$$A = \{\text{positive odd integers}\} \quad 1, 3, 5, 7, 9, \dots \text{ etc.}$$

$$B = \{\text{factors of } 20\}$$

- (A) A is a subset of B,  $A \subset B$   
 (B) B is a subset of A,  $B \subset A$   
 (C) The elements in the intersection of A and B,  $A \cap B$ , are {1, 5}  
 (D) The elements in the union of A and B,  $A \cup B$ , are {1, 5}

4. The table below shows the results of 52 people who own pets. Which Venn Diagram best represents the information in the table?

Cat	25
Dog	35

~~25-0-35~~  
~~1000~~  
~~1000~~

- (A) 68 total
- (B) 60 total
- (C) 44 total
- (D) 42 total

5. Consider the word MATH. In how many different ways can the letters be arranged?

- (A) 1  
 (B) 4  
 (C) 12  
 (D) 24
- 4!

6. There are 10 candies in a bag, 2 red, 3 white, and 5 blue. In how many ways can you select 3 candies so that you have one of each colour?

- (A)  $2 \cdot 3 \cdot 5$   
 (B)  $2!3!5!$   
 (C)  $\frac{10!}{2!3!5!}$   
 (D)  $10!$

7. A combination lock opens with the correct three-digit code. Each wheel rotates through the digits 0-9, where repetition is permitted. How many different codes are possible if the last digit is 5?

(A) 90  
 (B) 100  
 (C) 500  
 (D) 1000

$10 \cdot 10 \cdot 1 = 100$   
~~1000~~  
~~1000~~

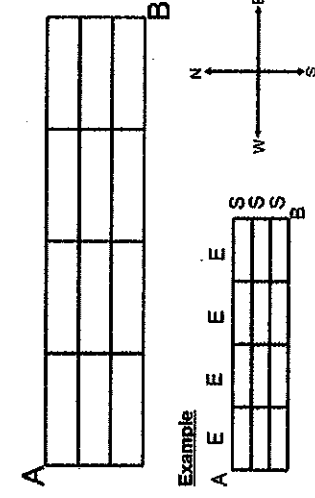
8. There are 6 girls and 8 boys on a committee. How many ways can a sub-committee of 2 girls and 2 boys can be selected?

combs

$$6C2 \times 8C2$$

- (A)  ${}^6C_2 + {}^8C_2$   
 (B)  ${}^6P_2 + {}^8P_2$   
 (C)  ${}^6C_2 \times {}^8C_2$   
 (D)  ${}^6P_2 \times {}^8P_2$

9. In the grid below, a person must travel from A to B by only heading East (E) or South (S). One example of the route is shown representing 4 moves East followed by 3 moves South (EEEESS). Under these rules, how many routes are there from A to B?



- (A)  $\frac{7!}{4!3!}$   
 (B)  $\frac{12!}{4!3!}$   
 (C)  $7!$   
 (D)  $12!$

10. Solve:

$$\frac{(n+2)!}{n!} = 20 \quad n \geq 0 \quad n \geq -2$$

$$\frac{(n+2)(n+1)n!}{n!} = 20 \quad \rightarrow (x+6)(n-3)$$

$n \neq 6$  ext.  
 $n = 3$

- (A)  $n = -1, n = -2$   
 (B)  $n = 3$   
 (C)  $n = 6$   
 (D) no solution

11. A standard six-sided die is rolled and a fair coin is tossed. What is the probability of rolling a 2 and tossing heads?

(A)  $\frac{1}{6} \times \frac{1}{2}$

- (B)  $\frac{2}{6} \times \frac{1}{2}$   
 (C)  $\frac{1}{6} + \frac{1}{2}$   
 (D)  $\frac{2}{6} + \frac{1}{2}$

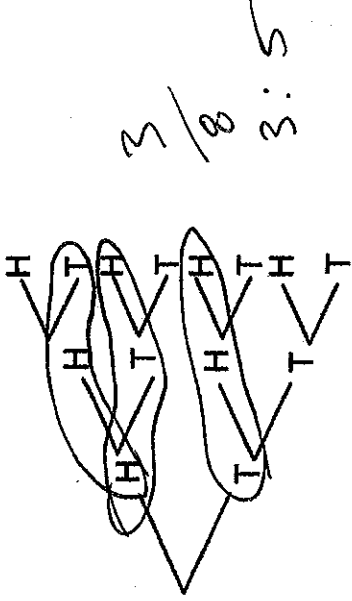
12. If the probability that the Montreal Canadiens will win their next game is 60%, what are the odds that they will win their next game?

(A) 2:3  
 (B) 3:2  
 (C) 3:5  
 (D) 5:3

in fav  $60\% = \frac{3}{5}$  3 win 2 loss  
 3:2

13. Given the following tree diagram when a fair coin is tossed three times. Determine the odds in favor of tossing 2 heads and a tail.

- (A) 3:5
- (B) 5:3
- (C) 3:8
- (D) 8:3



14. Bill has four loonies, three toonies, and five quarters in his pocket. He needs two loonies for a parking meter. He reaches into his pocket and pulls out two coins at random. Determine the probability that both coins are loonies.

- (A)  $\frac{1}{12}$
- (B)  $\frac{1}{11}$
- (C)  $\frac{1}{9}$
- (D)  $\frac{7}{12}$

$$\frac{4}{12} \cdot \frac{3}{11} = \frac{1}{11}$$

15. In a school of 120 students, 82% of the students have a cell phone, 50% of the students have a tablet, and 12 students have neither. Approximately how many students have both a cell phone and a tablet?

- (A) 38
- (B) 42
- (C) 50
- (D) 53

$$120 \cdot 0.5 = 60 \quad 120 - 12 = 108$$

$$120 \cdot 0.82 = 98 \quad 98 + 60 = 158$$

$$158 - 108 = 50$$

16. Which rational expression is equivalent to:  $\frac{5x}{3-x} + 3$

$$\frac{5x}{3-x} + 3 = \frac{5x + 3(3-x)}{3-x} = \frac{5x + 9 - 3x}{3-x} = \frac{2x + 9}{3-x}$$

- (A)  $\frac{15x}{3-x}$
- (B)  $\frac{15x}{9-3x} + 3$
- (C)  $\frac{5x}{9-3x}$
- (D)  $\frac{5x}{9-x}$

17. What is the lowest common denominator for the expression?

- (A)  $\frac{x+3}{(x+3)(x+3)}$   
 (B)  $\frac{5x}{(x+3)(x+3)}$   
 (C)  $\frac{2(x+3)}{2(x+3)}$   
 (D)  $\frac{2(x+3)(x+3)}{2(x+3)(x+3)}$
- Handwritten work:  
 $\frac{2x}{(x+3)(x+3)} - \frac{5x}{2(x+3)}$   
 ~~$\frac{2x}{(x+3)(x+3)}$~~   
 ~~$\frac{5x}{2(x+3)}$~~   
 LCD:  $2(x+3)(x+3)$

18. Simplify:

$$\frac{10x^3 - 20x^2}{5x^5 - 20x^3}, x \neq -2, 0, 2$$

- (A)  $\frac{2}{x(x-2)}$   
 (B)  $\frac{2}{x(x+2)}$   
 (C)  $\frac{2(x-2)}{x(x^2-4)}$   
 (D)  $\frac{2x-4}{x^3-4x}$
- Handwritten work:  
 $\frac{2 \cdot 10x^2(x-2)}{5x^3(x^2-4)}$   
 $\frac{2}{(x+2)(x-2)}$   
 $\frac{2}{x(x+2)}$

19. Simplify:

$$\frac{5x}{6} \div \frac{10x^4}{3}, x \neq 0$$

- (A)  $\frac{1}{4x^3}$   
 (B)  $4x^3$   
 (C)  $\frac{9}{25x^2}$   
 (D)  $\frac{25x^2}{9}$
- Handwritten work:  
 $\frac{5x}{6} \cdot \frac{3}{2 \cdot 10x^4}$   
 $\frac{1}{4x^3}$

20. Simplify:

$$\frac{3 \cdot 2}{6x^2} + \frac{1 \cdot 3x}{4x} \quad \text{LCD} = 12x^2$$

- (A)  $\frac{4}{10x^3}$   
 (B)  $\frac{3}{4x}$   
 (C)  $\frac{2+x}{4x^2}$   
 (D)  $\frac{2+x}{8x^3}$
- Handwritten work:  
 $\frac{6}{12x^2} + \frac{3x}{12x^2}$   
 $\frac{6x + 3x}{12x^2} = \frac{3(2+x)}{4 \cdot 12x^2}$   
 $= \frac{2+x}{4x^2}$

21. Solve:

$$\frac{2}{2x-6} = \frac{5}{4x+9}, \quad x \neq \frac{9}{4}, 3$$

- (A)   $x = -24$   
 (B)   $x = -6$   
 (C)   $x = 6$   
 (D)   $x = 24$

$$2(4x+9) = 5(2x-6)$$

$$8x+18 = 10x-30$$

$$LHS = 2x$$

$$RHS = x$$

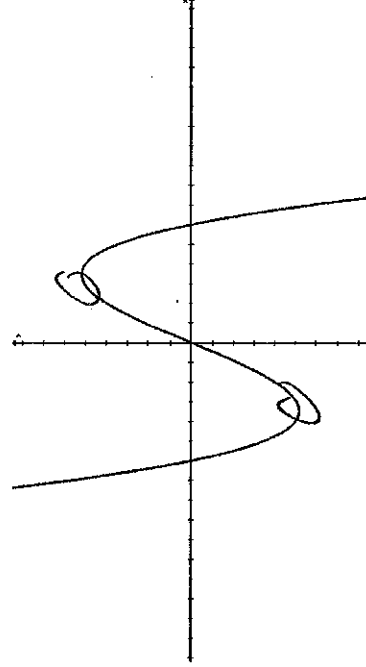
22. Given the function,  $f(x) = 3x^2 + [2x^3] + 10 - 2x$ , what is the y-intercept and the end behavior?

Positive cubic (III to I)

$$y_{int} (x=0) = 10$$

- (A)  QII to QI | -2  
 (B)  QII to QI | 10  
 (C)  QIII to QI | -2  
 (D)  QIII to QI | 10

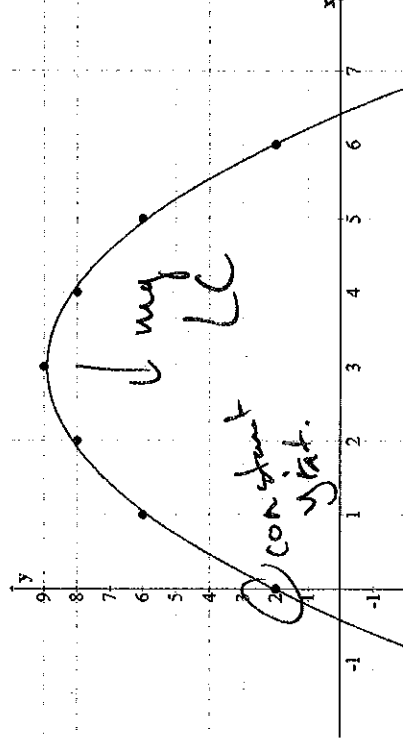
23. Given the graph below, determine the number of turning points.



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

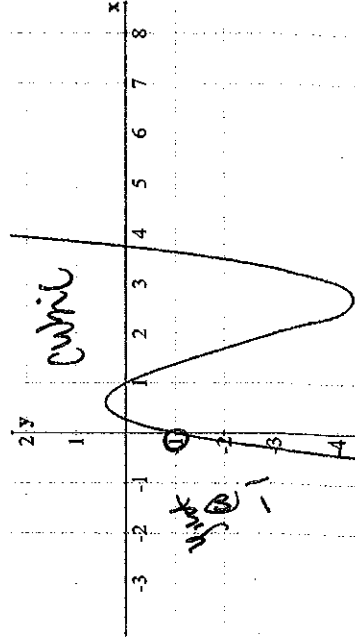
24. Given the table of values and the corresponding scatter plot, which statement is true of the quadratic regression equation?

0	2
1	6
2	8
3	9
4	8
5	6
6	2



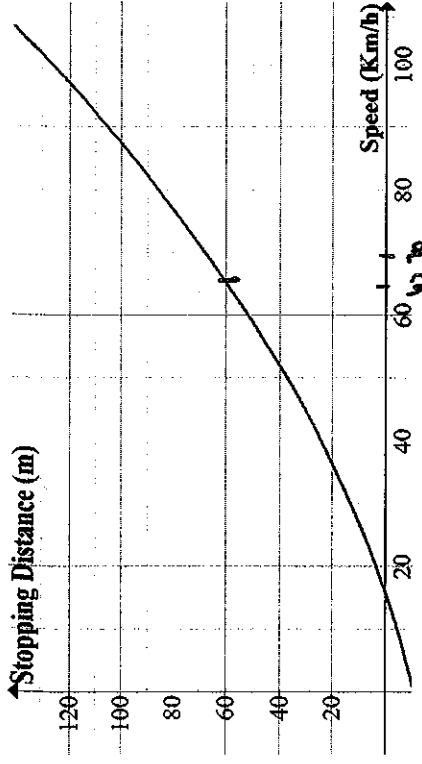
- (A)  negative | 2  
 (B)  negative | 6.5  
 (C)  positive | 2  
 (D)  positive | 6.5

25. What is the equation that best fits the characteristics of the polynomial function shown in the graph?



- (A)   $f(x) = 3x^2 + 3x - 1$   
 (B)   $f(x) = 2x^2 + 9x + 1$   
 (C)   $f(x) = x^3 - 5x^2 + 5x - 1$   
 (D)   $f(x) = 6x^3 + 5x^2 + 7x + 1$

26. Given the function,  $f(x) = 0.0083x^2 + 0.539x - 10.449$ , which describes the stopping distance of a car with respect to speed, what distance is required, in metres, if a car is travelling at 65km/h?



- (A) 25.11
- (B) 46.00
- (C) 58.39
- (D) 79.28

27. Given the quadratic function  $f(x) = 2(x - 3)^2 - 9$ , which is true about the corresponding graph?

- (A)   $(-3, -9)$
  - (B)   $(-3, -9)$
  - (C)   $(3, -9)$
  - (D)  $(3, -9)$
- off as is*  
 $\chi = 0 \quad 2(0-3)^2 - 9$   
 $18 - 9$   
 $9$   
*vertex (3, -9)*

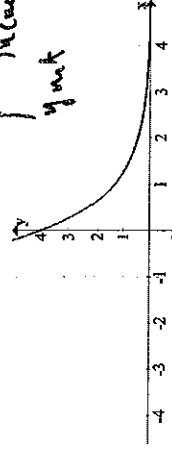
28. The function that models the decay of carbon-14 is  $A(t) = 150 \left(\frac{1}{2}\right)^{\frac{t}{4720}}$ , where  $A(t)$  is the number of grams of carbon-14 present at time,  $t$ , in years. Which statement is true?

- (A) Doubles every 4720 years and initial population of 300 g
  - (B) Doubles every 4720 years and initial population of 400 g
  - (C) Half-life every 4720 years and initial population of 75 g
  - (D) Half-life every 4720 years and initial population of 150 g
- half life of 4720*  
 $A_0 = 150$

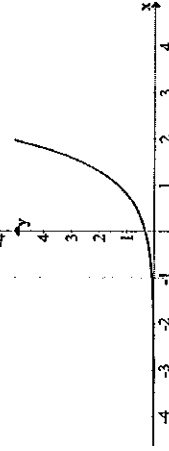


29. Which graph represents  $f(x) = \frac{1}{3}(4)^x$ ?

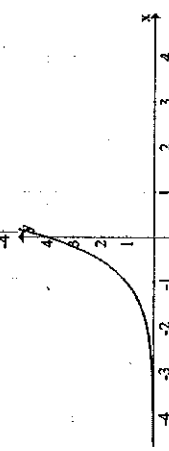
↑ increasing  
y axis



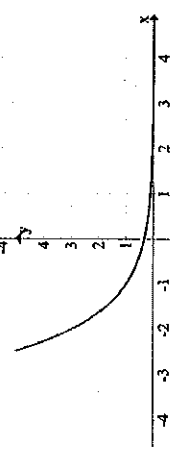
(A)



(B)



(C)



(D)

30. Solve for x:

$$(\sqrt{5})^{2x+4} = 25^{3x-1}$$

$$5^{\frac{1}{2}(2x+4)} = 5^{2(3x-1)}$$

$$x+2 = 6x-2$$

$$4 = 5x$$

$$\frac{4}{5} = x$$

- (A)  $\frac{4}{5}$
- (B) 1
- (C)  $\frac{3}{2}$
- (D) 5

31. Which of the following statements are true about  $f(x)$  and  $g(x)$ , if  $f(x) = \left(\frac{1}{4}\right)^x$  and  $g(x) = \left(\frac{3}{2}\right)^x$ ?

- (A) Both  $f(x)$  and  $g(x)$  are decreasing
- (B) Both  $f(x)$  and  $g(x)$  are increasing
- (C)  $f(x)$  is decreasing and  $g(x)$  is increasing
- (D)  $f(x)$  is increasing and  $g(x)$  is decreasing

dec

inc

32. Which is true of the table given below?  
*12.11.15* *4 years*

4	8	12	16	20
30	60	120	240	480

- (A) 15 Doubles every 4 years  
 (B) 15 Quadruples every 2 years  
 (C) 30 Doubles every 4 years  
 (D) 30 Quadruples every 4 years

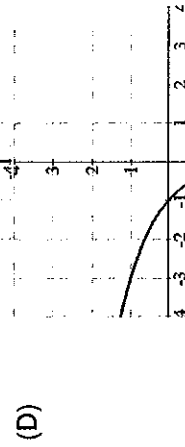
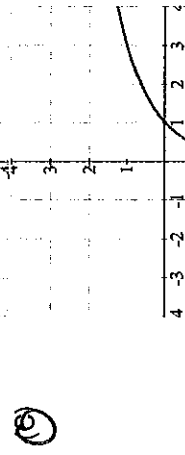
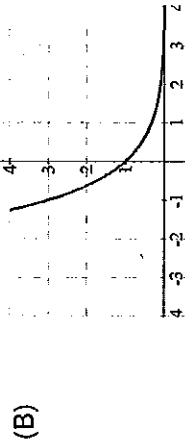
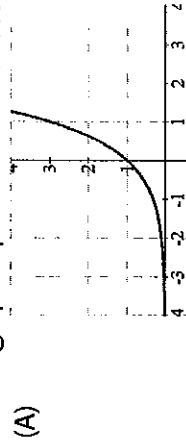
33. Marty invested in a \$2500 guaranteed investment certificate (GIC) at 2.5% simple interest, paid annually, with a term of 10 years. What is the future value of the investment?

- (A) \$3125  $2500 + 2500(0.025)(10)$   
 (B) \$3200  
 (C) \$8750  $2500 \times 625$   
 (D) \$65 000  $3125$

34. What is the logarithmic form of  $A = b^c$ ?

- (A)  $c = \log_b A$   
 (B)  $c = \log_A b$   
 (C)  $A = \log_b c$   
 (D)  $A = \log_c b$   
 $(= \log_b(A))$

35. Which graph represents the reflection of  $y = \log_3 x$  in the line  $y = x$ ?



36. Given the function  $\beta = 10(\log I + 12)$  where  $\beta$  is the sound level in decibels (dB) and  $I$  is the sound intensity, in watts per square metre ( $\text{W}/\text{m}^2$ ), what is the sound level when  $I = 1 \times 10^{-11}$ ?
- (A) 10  
 (B) 10.8  
 (C) 11.1  
 (D) 13.4

$$10 (\log (1 \times 10^{-11}) + 12)$$

37. What is  $\log_2 27 + \log_2 3 - \log_2 9$  written as a single logarithm?

- (A)  $\log_2 9$   
 (B)  $\log_2 21$   
 (C)  $\log_2 31$   
 (D)  $\log_2 81$

$$\log_2 (27 \cdot 3) - \log_2 9$$

$$\log_2 (81) - \log_2 9$$

$$\log_2 \left( \frac{81}{9} \right)$$

$$\log_2 9$$

38. Solve for  $x$ :

$$2^{x-1} = 5$$

- (A)  $\frac{\log 2}{\log 5} + 1$   
 (B)  $\frac{\log 2+1}{\log 5}$   
 (C)  $\frac{\log 5}{\log 2} + 1$   
 (D)  $\frac{\log 5+1}{\log 2}$

$$(x-1) \log 2 = \frac{\log 5}{\log 2} + 1$$

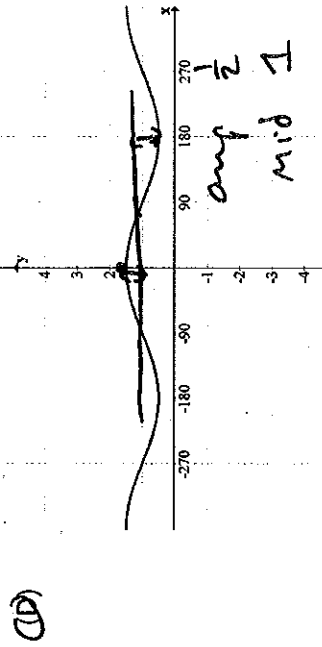
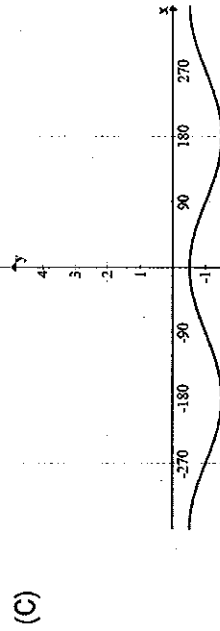
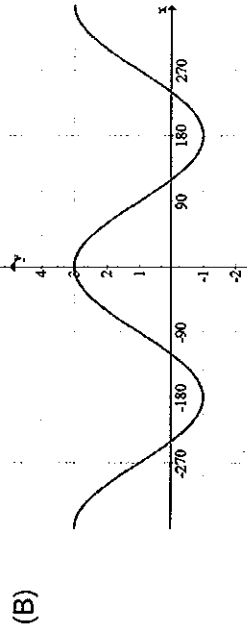
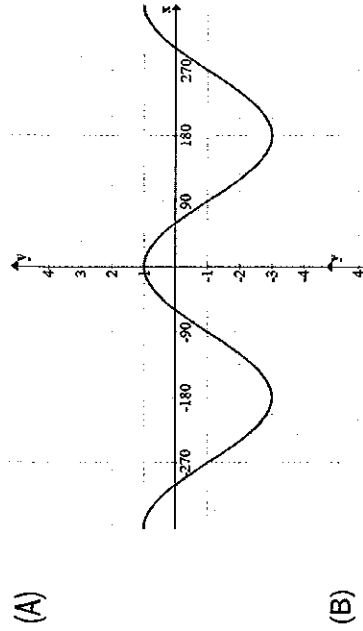
39. In which step did the error occur, in the following solution?

$$2 \log_5 3 + \log_5 4 - \log_5 6$$

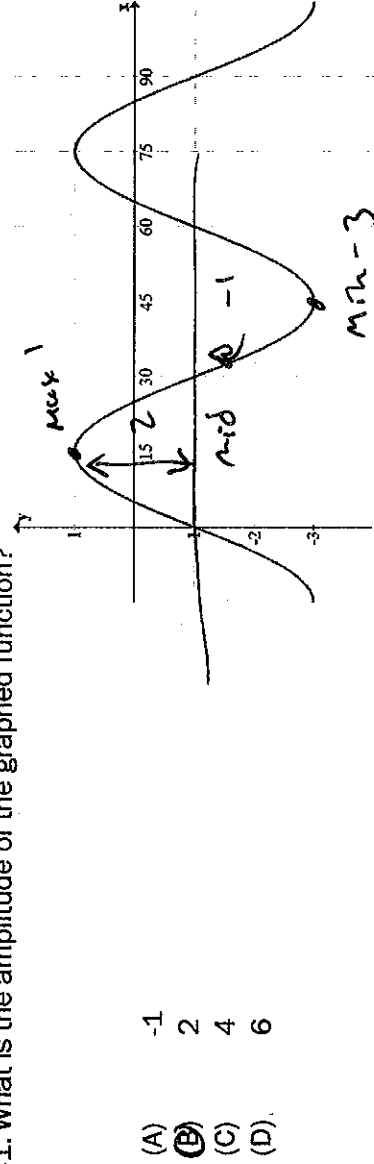
- Step 1  $= \log_5 3^2 + \log_5 4 - \log_5 6$   
 Step 2  $= \log_5 24 - \log_5 6$   
 Step 3  $= \log_5 \frac{24}{6}$   
 Step 4  $= \log_5 4$

- (A) Step 1  
 (B) Step 2  
 (C) Step 3  
 (D) Step 4

40. Which graph corresponds to  $= \frac{1}{2} \cos(x) + 1$  ?



41. What is the amplitude of the graphed function?

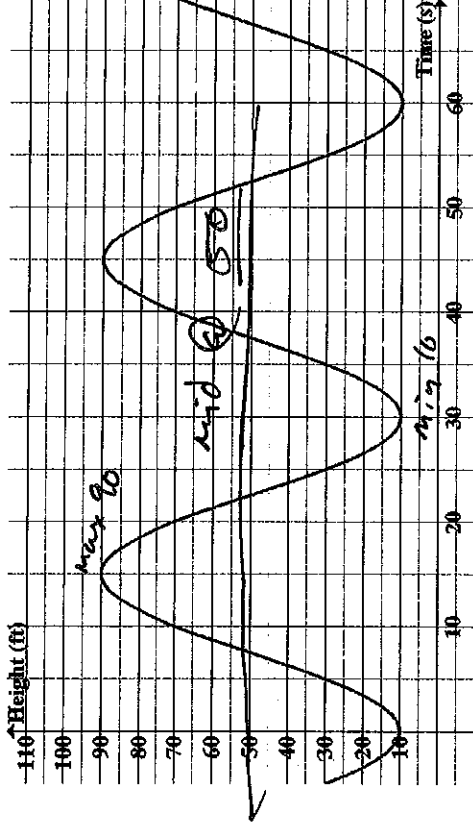


42. What is 7 radians written using degree measure?

- (A)  $0.12^\circ$   
 (B)  $200.54^\circ$   
 (C)  $\frac{401.70^\circ}{\pi} = 401.07$   
 (D)  $802.14^\circ$
- $7 \times \frac{180}{\pi} = \frac{1260}{\pi} = 401.07$

mid line

43. What is the height, in feet, of the center of the ferris wheel shown in the graph?



- (A) 30
- (B) 40
- (C) 50
- (D) 90

44. The height of a point on a Ferris Wheel can be modelled by  $h(t) = 50 \sin[2(t - 10)] + 30$  where  $h$  is the height in metres and  $t$  is time in seconds, what is the height of the point on the Ferris Wheel after 20 seconds? *not degrees*

- (A) 2.80
  - (B) 47.10
  - (C) 50.40
  - (D) 75.65
- Radian mode*  
 $50 (\sin 2(20 - 10)) + 30$   
~~max~~ ~~mid~~ ~~amp~~  
~~max~~ ~~mid~~ ~~amp~~  
~~mid~~ ~~amp~~  
~~mid~~ ~~amp~~  
~~mid~~ ~~amp~~  
~~mid~~ ~~amp~~

45. Given  $y = 3 \sin[2(x + 5)] - 10$ , what is the range?

- (A)  $\{y \mid -3 \leq y \leq 3, y \in \mathbb{R}\}$
- (B)  $\{y \mid -13 \leq y \leq -7, y \in \mathbb{R}\}$
- (C)  $\{y \mid 3 \leq y \leq 7, y \in \mathbb{R}\}$
- (D)  $\{y \mid -12 \leq y \leq -8, y \in \mathbb{R}\}$

*max: mid + amp - 10 + 3 = -7*  
*min: mid - amp - 10 - 3 = -13*

46. A bank loan of \$15 000 is borrowed at an interest rate of 5% compounded monthly. What was the loan balance after the second payment?

Period	Payment (\$)	Principal Paid (\$)	Balance (\$)
0			15 000
1	450	387.50	14 612.50
2	450	389.11	14 223.39
3	450	390.74	13 832.65

- (A) \$387.50
- (B) \$389.11
- (C) \$14223.39
- (D) \$14612.50

47. Bill is buying a new home that costs \$220 000. Using the screen provided, what will be the number of years to repay the loan?

*N = 360*  
*PV = 220000*  
*PMT = -1147.62414*  
*FV = 0*  
*P/Y = 12*  
*C/Y = 12*  
*PMT: BEGIN*

*Compound = 12*  
 $\frac{360}{12} = 30$

- (A) 3
- (B) 12
- (C) 30
- (D) 36

48. Which object will be most likely to appreciate over time?

- (A) car
  - (B) furniture
  - (C) iPhone
  - (D) house
- increase in value*  
*depreciate = decrease in value*

49. Tim would like to have a future value of \$12 000 on an investment. If the investment has an annual interest rate of 3% compounded quarterly for 5 years what would he need to invest initially?

- (A) \$6644.11
  - (B) \$10 334.28
  - (C) \$11 559.95
  - (D) \$11646.65
- $12000 = A_0 \left( \frac{1.0075}{1.0075} \right)^{20}$        $j = 0.03 \div 4 = 0.0075$   
 $10334.78 = A_0$        $n = 5 \cdot 4 = 20$

50.  $A = 2000(1.005)^{12}$  represents a bank loan that is compounded monthly. What is the annual interest rate?

- (A) 3%
  - (B) 5%
  - (C) 6%
  - (D) 12%
- ~~A~~       $0.005 \times 12 = 0.06 \times 100 = 6\%$

PART II

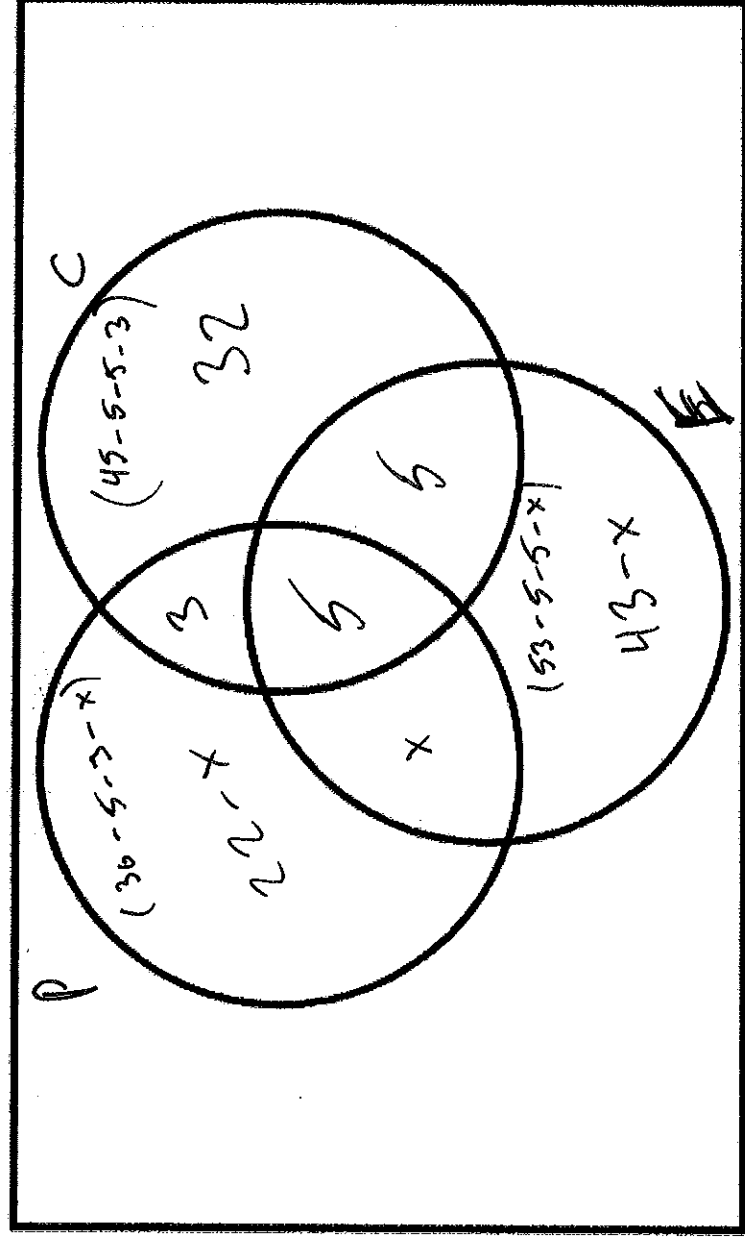
Total Value: 50%

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

Value

- 3 51. In a school of 100 students:
- 30 students took Physics
  - 45 students took Chemistry
  - 53 students took English
  - 3 students took only Physics and Chemistry
  - 5 students took only Chemistry and English
  - 5 students took all three

How many students took only Physics?



$$100 = (22-x) + (x) + (5) + (3) + (5) + (3) + (43-x)$$

$$100 = -x + 110$$

$$-10 = -x$$

$$10 = x$$

$$\begin{aligned} \text{only Physics} &= 22-x \\ &= 22-10 \\ &= 12 \end{aligned}$$

12 took only Physics

- 3 52. (a) Algebraically solve for  $n$ :  $n+2C_2 = 15$

$$\frac{(n+2)!}{(n+2-2)!2!} = 15 \cdot 2!$$

$$\frac{(n+2)!}{n!} = 30$$

$$\frac{(n+2)(n+1)n!}{n!} = 30$$

$$n^2 + 3n + 2 = 30$$

$$n^2 + 3n - 28 = 0$$

$$(n+7)(n-4) = 0$$

~~$n=7$~~  ext nest  
 $n=4$   $n+2=30$   
 $n-2=28$   
 $n \geq 0 \checkmark$

$$\text{check } \frac{(n+2)!}{4!2!} = \frac{6!}{4!2!} = \frac{6 \cdot 5 \cdot 4!}{4! \cdot 2!} = \frac{30}{2} = 15 \checkmark$$

$n=4$  is only sol<sup>n</sup>

52. (b) A four digit password consists of two uppercase letters followed by two numbers (digits 0 to 9), where repetition is allowed.

- 1 (i) What is the total number of possible passwords?

$$\underline{26} \cdot \underline{26} \cdot \underline{10} \cdot \underline{10} = 67600$$

- 1 (ii) What is the total number of possible passwords if repetition is not allowed and one digit must be even?

$$\underline{26} \cdot \underline{25} \cdot \underline{5} \cdot \underline{9} = 29250$$

even = 5



53. (a) There are 4 boys and 6 girls on a student council.

1 (i) What is the probability that a sub-committee of 5 members has 4 girls?

$$\text{total} = 10C5$$

$$\text{fav} = 6C4 \times 4C1$$

$$P = \frac{6C4 \times 4C1}{10C5} = \frac{15 \cdot 4}{252} = \frac{60}{252} = \frac{5}{21}$$

1 (ii) What is the probability that a sub-committee of 5 members has 3 girls and 2 boys?

$$\text{total} = 10C5$$

$$\text{fav} = 6C3 \times 4C2$$

$$P = \frac{6C3 \times 4C2}{10C5} = \frac{20 \times 6}{252} = \frac{120}{252} = \frac{10}{21}$$

2 (iii) What is the probability that a sub-committee of 5 members has at least 2 boys?

2 Boys

$$4C2 \cdot 6C3$$

$$6 \cdot 20$$

$$120$$

$$\text{total } 10C5 = 252$$

$$P = \frac{120 + 60 + 6}{252} = \frac{186}{252} = \frac{31}{42}$$

3 Boys

$$4C3 \cdot 6C2$$

$$4 \cdot 15$$

$$60$$

4 Boys

$$4C4 \cdot 6C1$$

$$1 \cdot 6$$

$$6$$

5 Boys

1 in poss.

53. (b) A six digit password is created using the digits 0 to 9 and the 26 letters of the alphabet. The password MUST begin and end with a letter with the remaining characters being digits.

- 2 (i) What is the probability that the password starts and ends with a vowel, if letters are not case sensitive and no repeating characters are allowed?

$$\text{Total } \underline{26} \underline{10} \underline{10} \underline{10} \underline{10} \underline{26} = 6760000$$

$$\text{Fav: vowels a e i o u} = 5 \quad \text{or} \quad \text{a e i o u y} = 6$$

$$\underline{5} \underline{10} \underline{1} \underline{8} \underline{7} \underline{4} = 100800$$

$$P = \frac{100800}{6760000} = \frac{63}{4225} \quad \text{or} \quad 0.015$$

$$P = \frac{151200}{6760000} = 0.022$$

- 2 (ii) Will the probability change in part 53.(b)(i) if the letters are case sensitive? Justify your answer.

$$\text{Total: } 52 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 52 = 27040000$$

$$\text{Fav } 10 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 9 = 453600$$

$$P = \frac{453600}{27040000} = 0.017 \quad \text{Yes } P \text{ changes}$$

$$\text{also fav 6 vowels Fav} = 12 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 12$$

$$P = \frac{665280}{27040000} = 0.025$$

54. (a) Jack purchased a box of comic books for \$330. He kept 3 for himself and sold the rest for \$288.

- 3 (i) If he made \$2 per comic book, how many were in the box that he purchased?

$$(x) \frac{288}{x-3} - 330 = 2(x) \quad \text{LCD} = x(x-3)$$

$$288x - [330x - 990] = 2x^2 - 6x$$

$$288x - 330x + 990 = 2x^2 - 6x$$

$$-42x + 990$$

$$0 = 2x^2 + 36x + 990$$

$$0 = x^2 + 18x + 495 \quad \text{impossible}$$

- 1 (ii) If Jack chose to keep 5 books instead and now makes \$6.80 profit on each one he sells, alter the equation provided in (i) to fit this new situation.

$$\frac{288}{x-5} - 330 = 6.80x$$

54. (b) Joe answered the following question on his test.

$$\begin{aligned} & \frac{3}{x-6} - \frac{x}{2x-12} \\ &= \frac{2(3)}{2(x-6)} - \frac{x}{2(x-6)} \\ &= \frac{6}{2(x-6)} - \frac{x}{2(x-6)} \\ &= \frac{6-x}{2(x-6)} \\ &= 2 \end{aligned}$$

- 1 (i) Identify any errors that Joe made

$\frac{6-x}{x-6}$  cancels to -1

five + two minus in denominator.  
Dont state ops.

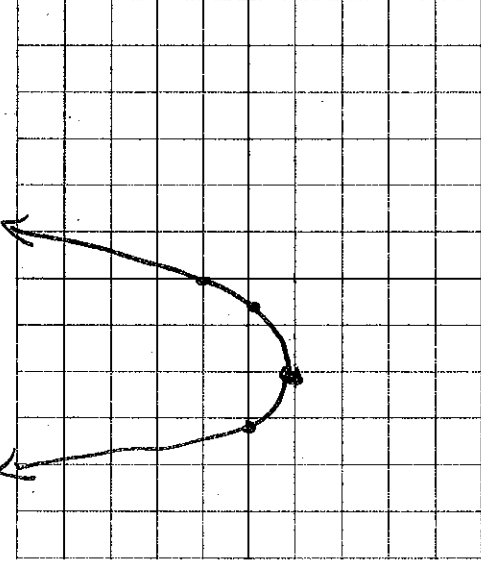
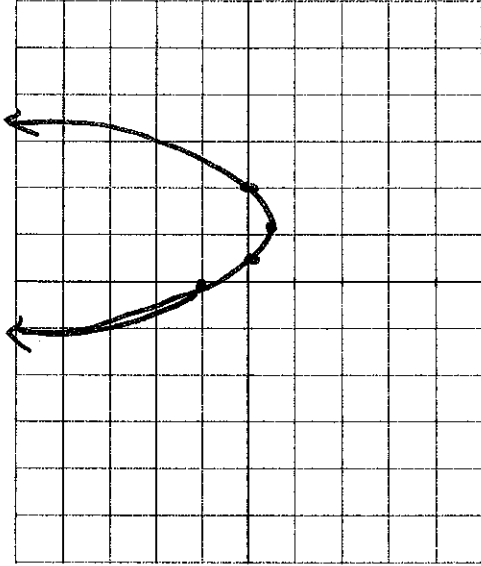
- 1 (ii) Provide a correct solution

$$= \frac{3 \cdot 2}{x-6} - \frac{x}{2(x-6)}$$

$$= \frac{6-x}{2(x-6)}$$

$$= -\frac{1}{2}$$

- 2 55. (a) Sketch two different polynomial graphs which have the same end behavior, number of turning points, and y-intercept

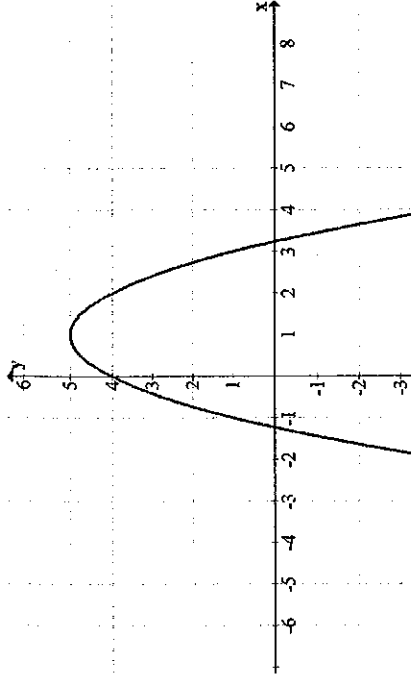


EG: II to I

y int @ 1

1 turning point

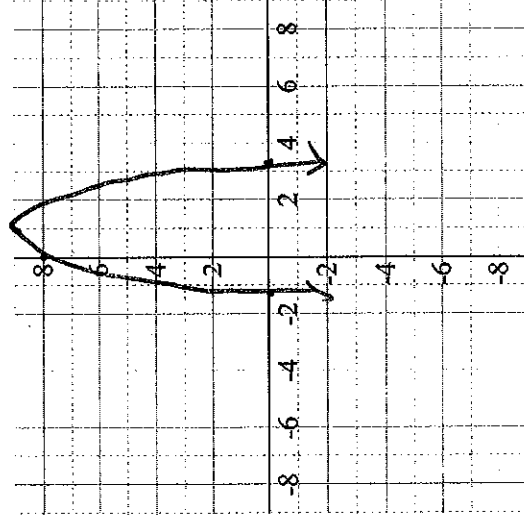
55. (b) Given the graph of the polynomial function below



- 2 (i) Determine the end behavior, the number of turning points, y-intercept, and degree.

End behaviour	III to IV
# of turning points	1
Y-intercept	(0, 4)
Degree	2

- 2 (ii) If the y-intercept of the graph given was increased to 8 while keeping the x-intercepts the same, sketch the resulting graph and describe how the change in the y-intercept affects the appearance of the graph.



3 56. (a) Algebraically solve

$$\sqrt{\frac{1}{8}} = 16^{3x-2}$$

$$\left(\frac{1}{8}\right)^{\frac{1}{2}} = 2^{4(3x-2)}$$

$$8^{-\frac{1}{2}} = 2^{12x-8}$$

$$2^{3(-\frac{1}{2})} = 2^{12x-8}$$

$$-\frac{3}{2} = 12x - 8$$

$$\frac{13}{2} = \frac{12x}{12}$$

$$\frac{13}{24} = x$$

2 56. (b) The population of trout in a lake can be modelled by the function  $P(x) = 200(2)^{\frac{x}{4}}$ . The number of bacteria in the lake can be modelled by  $A(t) = 14000(2)^{\frac{t}{5}}$ . Which population grows more quickly? Explain and justify your answer.

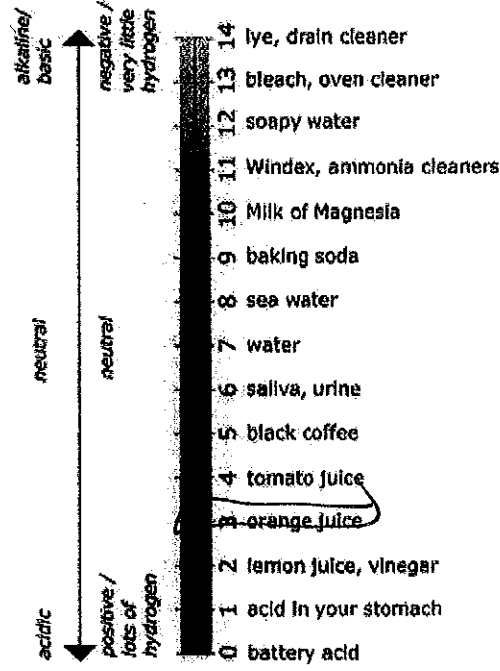
$P(x) = 200(2)^{\frac{x}{4}}$  increase faster because

it double in just 4 time periods

where as  $A(t) = 14000(2)^{\frac{t}{5}}$  double in

5 time periods.

57. (a) PH can be defined by the function  $P(x) = -\log(x)$  where the concentration of hydrogen ions,  $x$ , is measured in mol/L.



2 (i) Unknown substance A has a hydrogen ion concentration of 0.001 mol/L. What is this solution and how does it compare to saliva?

$$p(x) = -\log(0.001)$$

$$= 3$$

sub. is 0.5. more acidic than saliva

- 2 (ii) What is the hydrogen ion concentration of a solution of milk with a pH of 6.5?

$$f(x) = -\log(x)$$

$$x = 10^{-p(x)}$$

$$x = 10^{-6.5}$$

$$x = 10^{-6.5}$$

$$= 3.16 \times 10^{-7} \text{ mol/L}$$

57. (b) The half-life of a radioactive isotope is 30 hours. The amount the isotope can be modelled by the function  $A(t) = 1792 \left(\frac{1}{2}\right)^{\frac{t}{30}}$ .

- 1 (i) How much of the isotope is left after 20 hours?

$$A(20) = 1792 \left(\frac{1}{2}\right)^{\frac{20}{30}}$$

$$A(20) = 1128.89$$

- 3 (ii) The half-life of Carbon-14 is 35 hours. The amount of Carbon-14,  $A(t)$ , at time  $t$ , can be modelled by the function  $A(t) = A_0 \left(\frac{1}{2}\right)^{\frac{t}{35}}$ . Algebraically determine how long it will take for a sample of 1851 mg to decay to 52 mg.

$$\frac{52}{1851} = \frac{1851}{1851} \left(\frac{1}{2}\right)^{\frac{t}{35}}$$

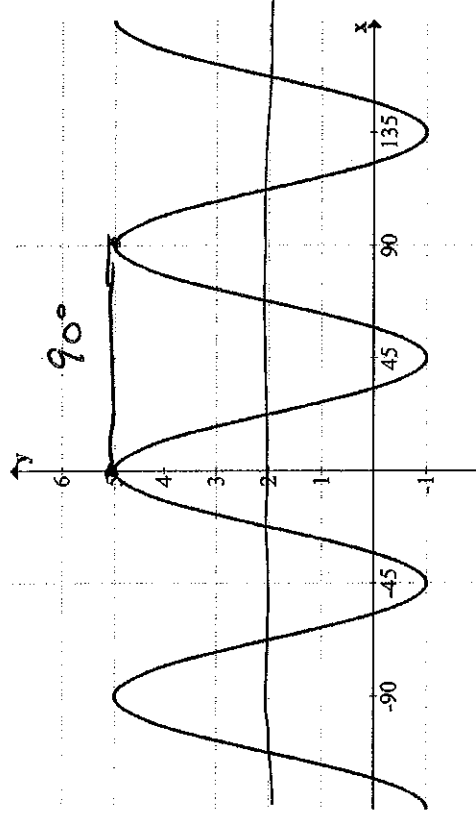
$$0.02809 = (0.5)^{\frac{t}{35}}$$

$$\frac{\log(0.02809)}{\log(0.5)} = \frac{t}{35}$$

$$35 \cdot 5.1536 = \frac{t}{35}$$

$$180.4 \text{ hours} = t$$

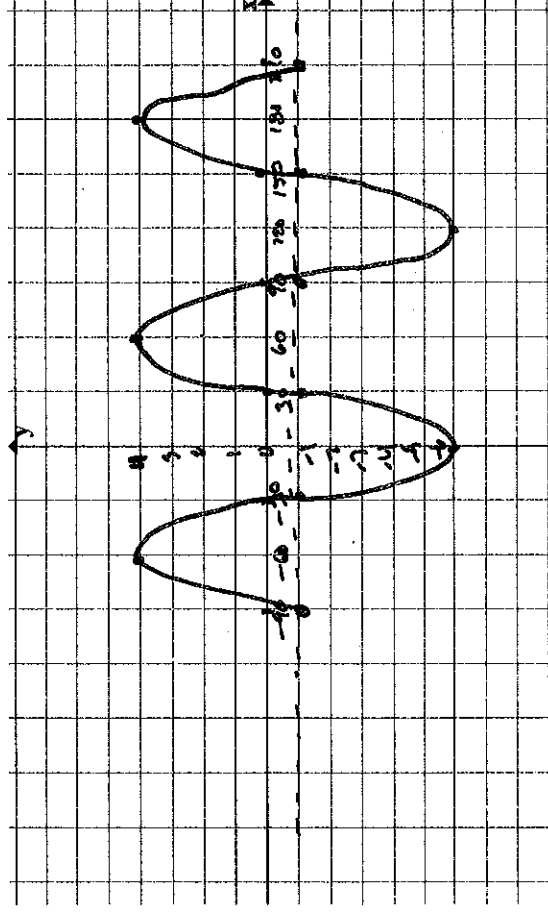
- 4 58. (a) Use the sinusoidal function shown to complete the following table.



Amplitude	3
Period	$90^\circ$
Equation of Midline	$y = 2$
Maximum Value	5
Minimum Value	-1

- 2 58. (b) Sketch a sinusoidal function with the following characteristics:

- Domain:  $-90^\circ \leq x \leq 210^\circ$
- Period:  $120^\circ$
- Range:  $-6 \leq y \leq 4$
- Y-intercept:  $(0, -6)$



- 4 59. Mary borrows \$1200 at 8% interest compounded annually. Doug borrows \$1000 at 10% interest compounded annually. Write an exponential equation for each option and determine which is the best, if borrowed over 7 years.

Mary:

$$i = 0.08 \div 1 = 0.08$$

$$n = 1 \times 7 = 7$$

$$A = 1200(1.08)^7$$

$$A = \$2056.59$$

Interest:

$$2056.59 - 1200$$

$$\$856.59$$

Doug:

$$i = 0.10 \div 1 = 0.10$$

$$n = 1 \times 7 = 7$$

$$A = 1000(1.10)^7$$

$$A = \$1948.72$$

Interest:

$$1948.72 - 1000$$

$$\$948.72$$

Mary has better option  
gets bigger loan and  
pays less interest.