Menihek High School

STUDENT'S NAME _____

TEACHER'S NAME _____

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

MIDYEAR EXAMINATION

MATHEMATICS 3204

January 25, 2011

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: 50%

   PART II: Constructed Response Value: 50%
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)

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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. Which is a quadratic sequence?

   (A) {0, 3, 6, 9, 12, ...}

   (B) {1, 2, 4, 8, 16, ...}

   (C) {15, 8, 3, 0, -1, ...}

   (D) {27, 64, 125, 216, 343...}

2. What is the first level difference of the sequence $t_n = \frac{1}{5}n + \frac{2}{5}$?

   (A) $\frac{1}{5}$

   (B) $\frac{3}{10}$

   (C) $\frac{2}{5}$

   (D) $\frac{3}{5}$

3. Which equation is represented by the sequence $\{-10,\ -4,\ 2,\ 8,\ 14, \ldots\}$?

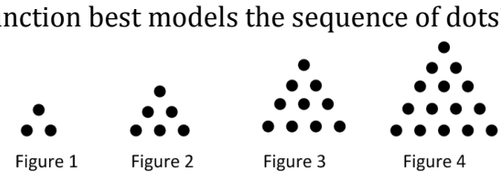
   (A) $t_n = -10n + 16$

   (B) $t_n = -6n - 16$

   (C) $t_n = 6n - 10$

   (D) $t_n = 6n - 16$

4. Which type of function best models the sequence of dots?



   (A) cubic

   (B) exponential

   (C) linear

   (D) quadratic

5. Which type of function is shown in the table?

x	1	2	3	4	5
y	0	7	26	63	124

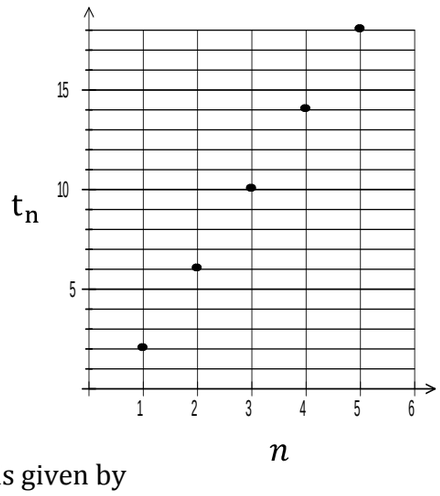
(A) cubic

(B) exponential

(C) linear

(D) quadratic

6. Which equation represents the graph?



(A) $t_n = 4n - 2$

(B) $t_n = -4n + 2$

(C) $t_n = 2n$

(D) $t_n = 4n$

7. The path of an eagle as it dives towards the ground is given by $h(t) = 2t^2 - 12t + 20$, where t is the time in seconds and $h(t)$ is the height in metres. At what time, in seconds, does the bird reach its minimum height?

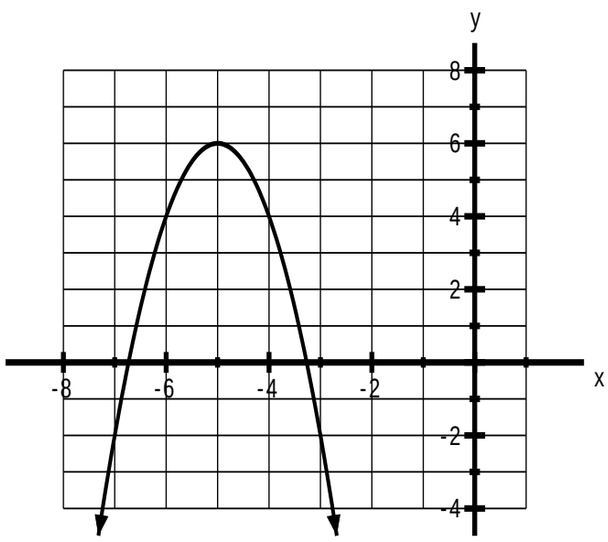
(A) 2

(B) 3

(C) 6

(D) 20

8. Which equation represents the graph?



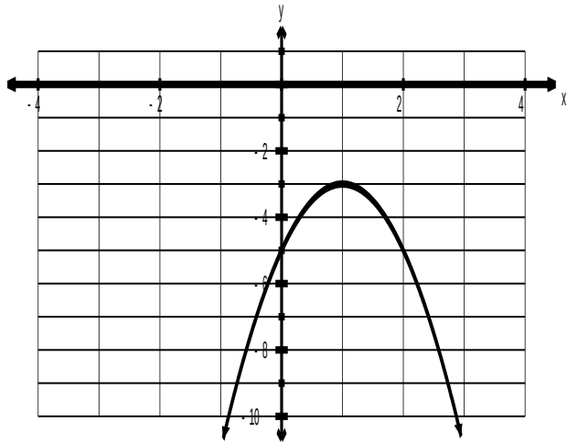
(A) $-2(y-6) = (x+5)^2$

(B) $-\frac{1}{2}(y-6) = (x+5)^2$

(C) $\frac{1}{2}(y-6) = (x+5)^2$

(D) $2(y-6) = (x+5)^2$

9. What is the range of the graph?



(A) $\{y|y \leq -3, y \in R\}$

(B) $\{y|y \geq -3, y \in R\}$

(C) $\{y|y \leq 1, y \in R\}$

(D) $\{y|y \geq 1, y \in R\}$

10. What is the equation of the axis of symmetry of $-\frac{1}{25}(y-100) = (x-60)^2$?

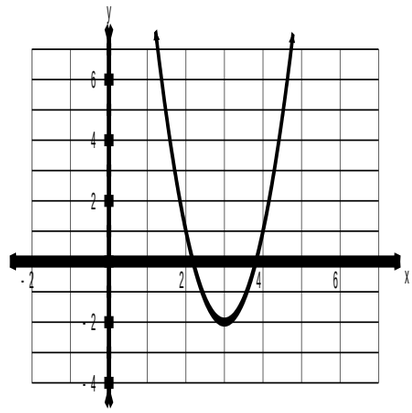
(A) $x = -60$

(B) $x = 60$

(C) $y = -100$

(D) $y = 100$

11. The graph of a quadratic function has a minimum of $(3, -2)$ and passes through the point $(4,1)$. What is the vertical stretch factor?



(A) -1

(B) $-\frac{1}{49}$

(C) $\frac{1}{3}$

(D) 3

12. What is the mapping rule that describes the transformation of $y = x^2$ after a translation of 3 units to the right, 1 unit down, and a reflection in the x axis?

(A) $(x, y) \rightarrow (x-3, -y+1)$

(B) $(x, y) \rightarrow (x-3, y+1)$

(C) $(x, y) \rightarrow (x+3, y-1)$

(D) $(x, y) \rightarrow (x+3, -y-1)$

13. What is the general form of $y = 5(x-2)^2 + 6$?

(A) $-\frac{1}{5}(y+6) = (x-2)^2$

(B) $\frac{1}{5}(y-6) = (x-2)^2$

(C) $y = 5x^2 - 20x + 26$

(D) $y = 5x^2 - 20x + 50$

14. What is the vertical translation if $y = x^2$ is transformed to $y = -\frac{1}{2}(x + 10)^2 - 21$?

(A) 21 units down

(B) 10 units down

(C) 10 units up

(D) 21 units up

15. What value of b makes the expression $x^2 + bx + 100$ a perfect square?

(A) 10

(B) 20

(C) 50

(D) 2500

16. The x-intercepts of a quadratic function are $(-4,0)$ and $(2, 0)$. What is the x-coordinate of the vertex?

(A) -3

(B) -2

(C) -1

(D) 0

17. What is the standard form of $\frac{2}{3}(y + 3) = (x - 10)^2$?

(A) $y = -\frac{3}{2}(x - 10)^2 - 3$

(B) $y = -\frac{3}{2}x^2 - 30x + 147$

(C) $y = \frac{3}{2}(x - 10)^2 - 3$

(D) $y = \frac{3}{2}x^2 - 30x + 153$

18. Which equation represents the transformation of $y = x^2$, under the mapping rule $(x, y) \rightarrow (x, 2y - 7)$?

(A) $-2(y + 7) = x^2$

(B) $-2(y - 7) = x^2$

(C) $\frac{1}{2}(y + 7) = x^2$

(D) $\frac{1}{2}(y - 7) = x^2$

19. What are the roots of $x^2 + 20 = 0$?

(A) $x = \pm 2\sqrt{5}$

(B) $x = \pm 2i\sqrt{5}$

(C) $x = \pm 5\sqrt{2}$

(D) $x = \pm 5i\sqrt{2}$

20. What are the zeros of $y = x^2 + 4x - 12$?

(A) $x = -6,\ x = -2$

(B) $x = -6,\ x = 2$

(C) $x = -2,\ x = 6$

(D) $x = 2,\ x = 6$

21. What are the x-intercepts of the graph of $y = 10x^2 + 3x$. ?

(A) $x = 0,\ x = -\frac{3}{10}$

(B) $x = 0,\ x = \frac{3}{10}$

(C) $x = 1,\ x = -\frac{3}{10}$

(D) $x = 1,\ x = \frac{3}{10}$

22. The vertex of a quadratic function is $(-3, -2)$ and the graph opens upward. What is the nature of the roots?

(A) imaginary and equal

(B) imaginary and unequal

(C) real and equal

(D) real and unequal

23. What is the discriminant of $y = -3x^2 - 2x - 4$?

(A) -44

(B) 52

(C) $2i\sqrt{11}$

(D) $\pm 2\sqrt{13}$

24. For what value(s) of k does $-2x^2 + 8x + k = 0$ have real and unequal roots?

(A) $k < -8$

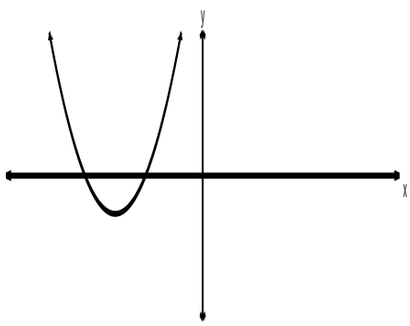
(B) $k = -8$

(C) $k > -8$

(D) $k = 8$

25. The discriminant of a quadratic function is less than zero. Which is the correct graph for the function?

(A)



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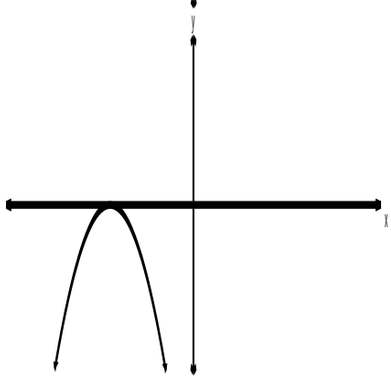

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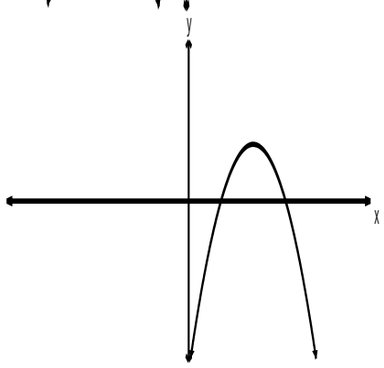

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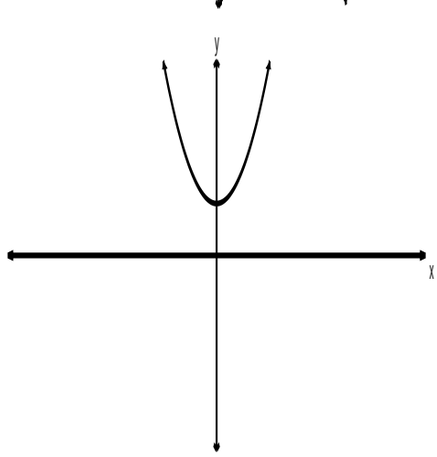


26. What is the vertex of the function $y = 2x^2 + 8x + 9$?

(A) $(-2, 1)$

(B) $(-2, 9)$

(C) $(2, 33)$

(D) $(2, 41)$

27. What is the simplest form of $\frac{-8 \pm \sqrt{-12}}{2}$?

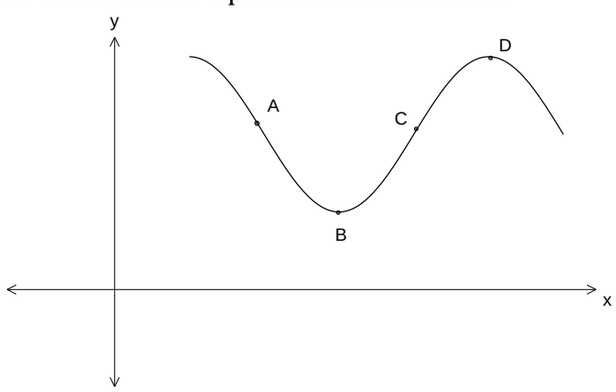
(A) $-4 \pm i\sqrt{3}$

(B) $-4 \pm 2i\sqrt{3}$

(C) $-4 \pm 3i\sqrt{2}$

(D) $-4 \pm i\sqrt{6}$

28. At which point could a tangent be drawn to best indicate a positive instantaneous rate of change?



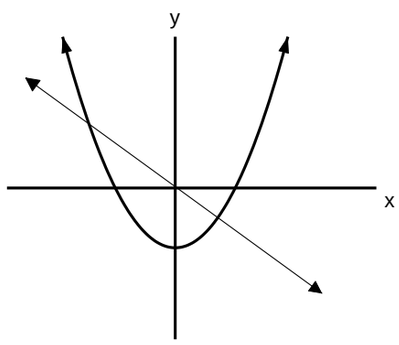
(A) A

(B) B

(C) C

(D) D

29. Which rate of change is modeled by the graph?



(A) negative average rate of change

(B) negative instantaneous rate of change

(C) positive average rate of change

(D) positive instantaneous rate of change

30. What is the average rate of change of $f(x) = x^2$ between $x = 2$ and $x = 4$?

(A) -6

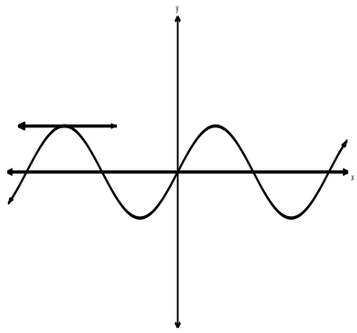
(B) $-\frac{1}{6}$

(C) $\frac{1}{6}$

(D) 6

31. Which line displays an instantaneous rate of change of zero?

(A)



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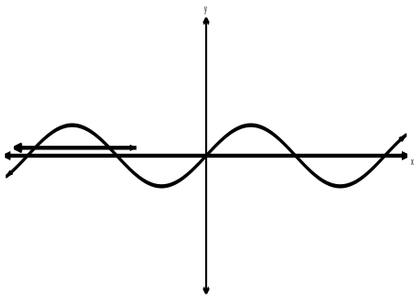

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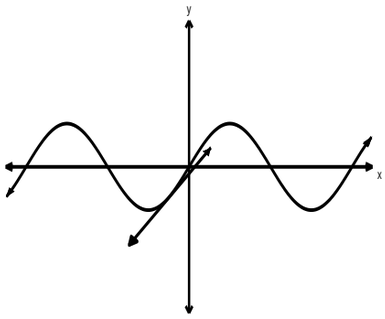

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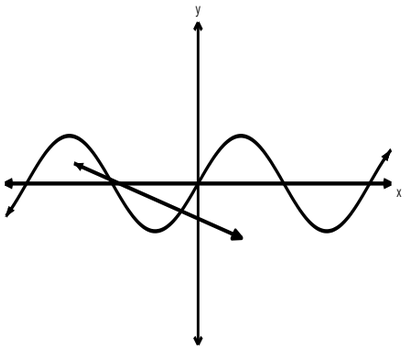


32. What is the equation of the horizontial asymptote of $y = 3\left(\frac{1}{2}\right)^x - 5$?

(A) $x = -5$

(B) $x = 5$

(C) $y = -5$

(D) $y = 5$

33. Simplify: $\left(\frac{1}{2}\right)^{-3}$

(A) $\frac{1}{8}$

(B) $\frac{1}{6}$

(C) 6

(D) 8

34. What is the range of $y = 2(5)^x + 3$?

(A) $\{y|y < 3, y \in R\}$

(B) $\{y|y \leq 3, y \in R\}$

(C) $\{y|y > 3, y \in R\}$

(D) $\{y|y \geq 3, y \in R\}$

35. What type of function is illustrated by the table shown?

x	1	2	3	4	5	6
y	6	12	24	48	96	192

(A) cubic

(B) exponential

(C) linear

(D) quadratic

36. Which function is growing at the slowest rate from $x = 1$ to $x = 4$?

(A) $y = (-3)^x$

(B) $y = \left(\frac{1}{3}\right)^x$

(C) $y = 3^x$

(D) $y = 9^x$

37. The temperature of a cup of hot tea is defined by the function $T = 80(0.7)^{\frac{t}{5}} + 20$, where T is the temperature in degrees Celsius and t is the time in minutes. What is the initial temperature, in degrees Celsius, of the tea?

(A) 20

(B) 70

(C) 80

(D) 100

38. Which represents a geometric sequence?

(A) $\{3, 3+2, 3+2+2, \ldots\}$

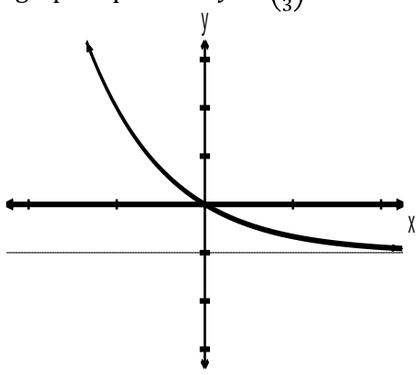
(B) $\{3, 3(2), 3(3), 3(4), \ldots\}$

(C) $\{3, 3+3^2, 3+3^3, \ldots\}$

(D) $\{3, 3(2), 3(2)^2, 3(2)^3, \ldots\}$

39. Which graph represents $y = \left(\frac{1}{3}\right)^x + 1$?

(A)



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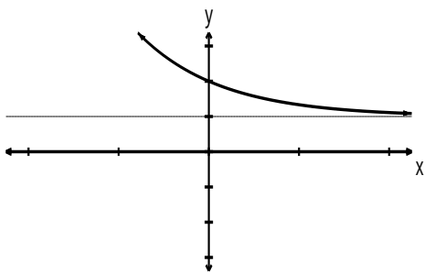
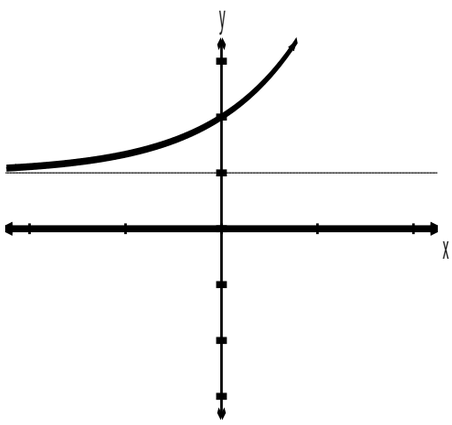


(C)



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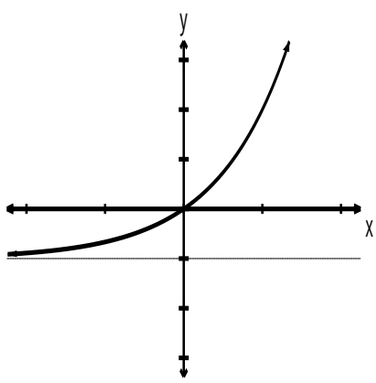


40. Which describes the function $y = 3\left(\frac{1}{2}\right)^x + 4$?

(A) exponential decay, asymptote $y = 4$

(B) exponential decay, asymptote $y = -4$

(C) exponential growth, asymptote $y = 4$

(D) exponential growth, asymptote $y = -4$

41. Which function models a situation where a house valued at \$100 000 appreciates by 2% annually?

(A) $A = 100\,000(0.02)^x$

(B) $A = 100\,000(0.98)^x$

(C) $A = 100\,000(1.02)^x$

(D) $A = 100\,000(1.2)^x$

42. Which function represents the following data?

x	0	2	4	6	8
y	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4

(A) $y = \frac{1}{4}(2)^{\frac{x}{2}}$

(B) $y = \frac{1}{4}(2)^{2x}$

(C) $y = \frac{1}{4}\left(\frac{1}{2}\right)^{\frac{x}{2}}$

(D) $y = \frac{1}{4}\left(\frac{1}{2}\right)^{2x}$

43. Initially there are 500 bacteria. The number of bacteria triples every 4 hours. Which equation models this situation?

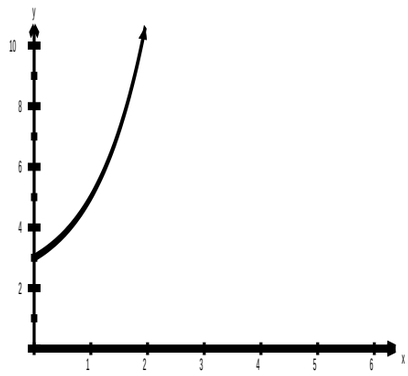
(A) $y = 500(3)^{\frac{x}{4}}$

(B) $y = 500(3)^{4x}$

(C) $y = 500(4)^{\frac{x}{3}}$

(D) $y = 500(4)^{3x}$

44. What is the domain of the function graphed below?



(A) $\{X|X \geq 0, X \in R\}$

(B) $\{X|X \in R\}$

(C) $\{Y|Y \geq 3, Y \in R\}$

(D) $\{Y|Y \in R\}$

45. What is the y-intercept of $y = 2(3)^x - 4$?

(A) $(0, -4)$

(B) $(0, -2)$

(C) $(0, 2)$

(D) $(0, 4)$

46. Evaluate: $\left(\left(\frac{2}{3}\right)^{-1} + 2^0\right)^2$

(A) $\frac{25}{9}$

(B) $\frac{13}{4}$

(C) $\frac{25}{4}$

(D) $\frac{64}{9}$

47. Evaluate the exponential function $y = 6(3)^x + 4$ at $x = -1$?

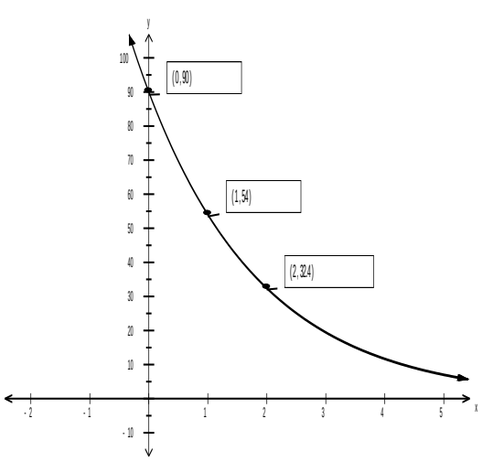
(A) -14

(B) -2

(C) 2

(D) 6

48. What is the common ratio for the graph?



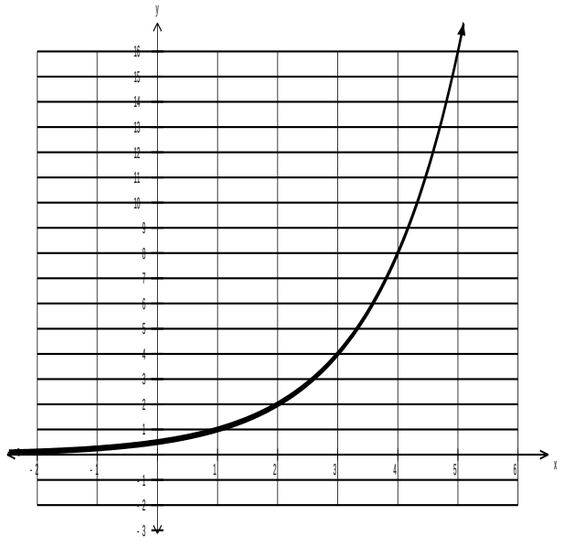
(A) $-1.\overline{6}$

(B) -0.6

(C) 0.6

(D) $1.\overline{6}$

49. Given the graph of $f(x)$, determine the value of x when $f(x) = 4$.



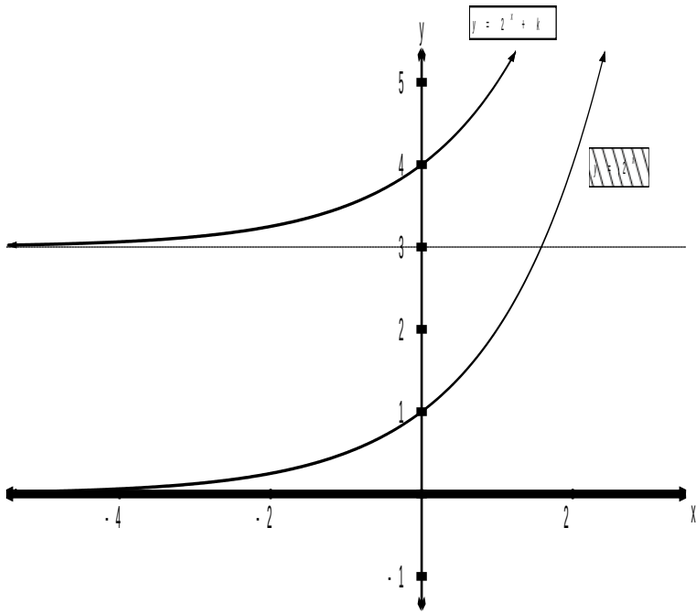
(A) 2

(B) 3

(C) 4

(D) 8

50. The graphs of $y = 2^x$ and $y = 2^x + k$ are shown. What is the value of k?



(A) 1

(B) 2

(C) 3

(D) 4

PART II

Total Value 50%

Answer **ALL** items in the on the loose leaf provided in order with the exception of **question 61.** Show **ALL** workings.

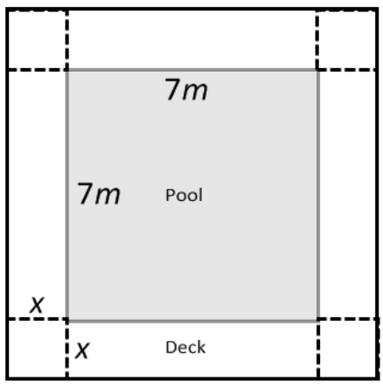
Value

4 51. Algebraically determine the EXACT roots, in simplest form, of

$$5x^2 + 3 = 2x(x + 4).$$

4 52. Change the equation $y = 5x^2 + 40x + 83$ into transformational form.

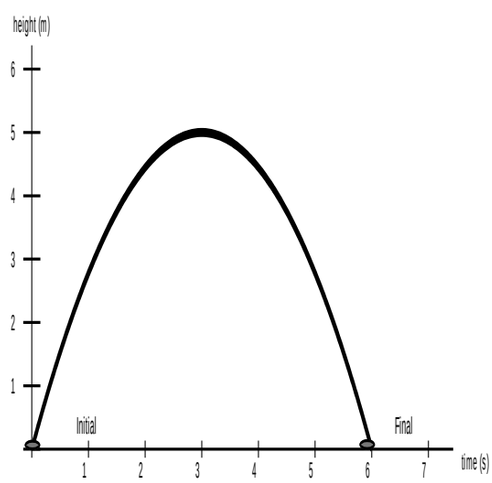
4 53. A swimming pool measuring 7 m by 7 m is surrounded by a deck of uniform width. If the combined area of the pool and the deck is 121 m^2, algebraically find the width of the deck.



4 54. Algebraically determine two **positive** consecutive numbers whose product is 210.

4 55. A student throws his calculator and the calculator follows a parabolic path that is described by the function $h(t) = -2t^2 + 8t + 13$ where t is the time in seconds and $h(t)$ is the height in metres. Algebraically, determine the time required to reach the maximum height and the maximum height of the calculator.

4 56. A child kicks a soccer ball and it reaches a maximum height of 5 m in 3 s. The soccer ball hits the ground in 6 s. Algebraically determine the quadratic function that models the situation.



Value 4 57. A crow at the top of a 22 m building swoops down to chase away a blue jay. The crow follows a parabolic path given by the function $h(t) = 2t^2 - 12t + 22$, where $h(t)$ is the height in metres and t is the time in seconds. Algebraically, determine the time(s) when the crow reaches a height of 12 m.

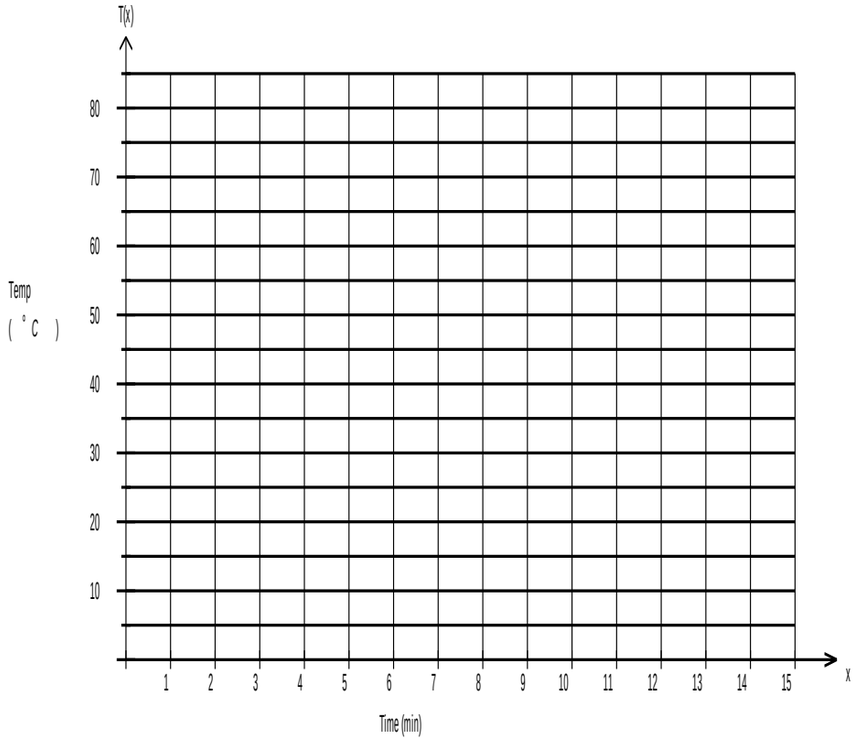
4 58. The path of a toy rocket is modeled by $h(t) = -2t^2 + 50t$ where $h(t)$ is the height in metres and t is the time in seconds. What is the average rate of change in the height of the toy rocket between $t = 1$ and $t = 3$?

4 59. The path of a moving particle is given by the equation $s = 11t^2 - 7t - 10$, where s is the distance in metres and t is the time in seconds. Algebraically determine the instantaneous rate of change in the distance at 3 seconds?

3 60. An element has a half-life of 150 years. If its initial mass is 60 grams, determine an exponential function and use it to find the amount of the element remaining after 450 years?

3 61. $T(x) = 60\left(\frac{1}{2}\right)^{\frac{x}{3}} + 20$ represents the temperature of a cooling liquid over time, where $T(x)$ is the temperature, in degrees Celsius, and x is the elapsed time, in minutes. Complete the table of values provided and sketch the graph of the function, including the asymptote.

x in minutes	$T(x)$ in Celsius
0	
3	
6	
9	
12	



4 62. A skateboard was purchased in 2006 and depreciated 8% every 2 years. If the current value of the skateboard in 2011 is $180, determine an exponential function and use it to find the original value of the skateboard?

Value

4 63. Initially there were 50 cell phones in a community. The number of cell phones increased according to the data in the table. Algebraically determine an equation that models the number of cell phones, C, over time, t. Use the equation to predict the number of cell phones after 25 years.

Time in years, t	0	4	8	12	16
Number of cell phones, C	50	100	200	400	800

END