



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 26, 2010

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 type of sequence is $\{-1, -4, -7, -10, -13, \dots\}$?

- (A) arithmetic
- (B) cubic
- (C) geometric
- (D) quadratic

2. What is the first level difference for the sequence $t_n = 3 - \frac{2}{5}n$?

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

3. Which represents a quadratic relationship?

(A)

x	1	2	3	4	5
y	1	8	27	64	125

(B)

x	1	2	3	4	5
y	6	9	14	21	30

(C)

x	1	2	3	4	5
y	7	9	11	13	15

(D)

x	1	2	3	4	5
y	3	9	27	81	243

4. What is the second level difference for the sequence $t_n = 4n^2 - 2n + 1$?

- (A) 2
- (B) 4
- (C) 8
- (D) 10

5. Which equation is represented by the sequence $\{5, 8, 11, 14, 17, 20, \dots\}$?

(A) $t_n = -3n + 8$

(B) $t_n = -3n + 4$

(C) $t_n = 3n + 2$

(D) $t_n = 3n + 4$

6. What is the transformational form of $y = -4(x + 3)^2 - 1$?

(A) $-4(y + 1) = (x + 3)^2$

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

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

(D) $4(y + 1) = (x - 3)^2$

7. What is the maximum value of $y = -\frac{1}{2}(x - 4)^2 + 3$?

(A) $(-4, -3)$

(B) $(-4, 3)$

(C) $(4, -3)$

(D) $(4, 3)$

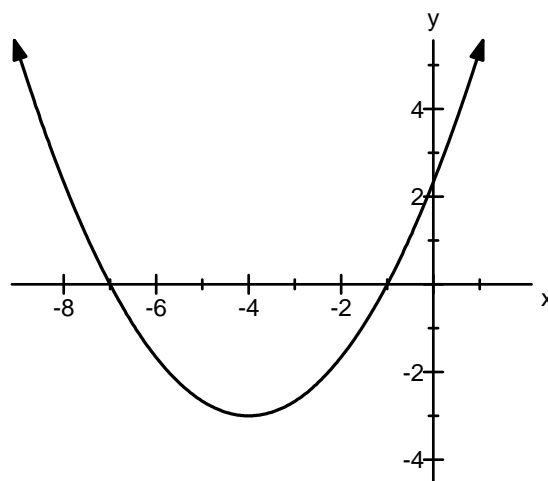
8. Which mapping rule will produce the graph below?

(A) $(x, y) \rightarrow (x - 4, \frac{1}{3}y - 3)$

(B) $(x, y) \rightarrow (x - 4, 3y - 3)$

(C) $(x, y) \rightarrow (x + 4, \frac{1}{3}y + 3)$

(D) $(x, y) \rightarrow (x + 4, 3y + 3)$



9. What is the general form of $y = (x - 2)^2 + 7$?

(A) $y = x^2 + 11$

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

(C) $y = x^2 - 4x + 3$

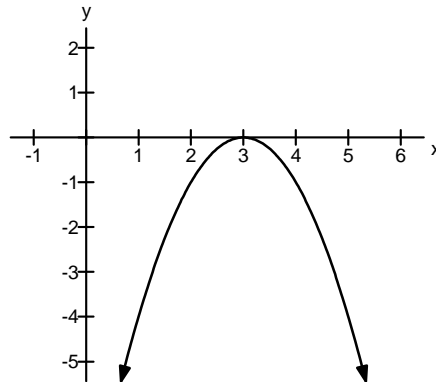
(D) $y = x^2 - 4x + 11$

10. What is the equation of the axis of symmetry of $\frac{3}{2}(y - 5) = (x - 3)^2$?

- (A) $x = -3$
- (B) $x = 3$
- (C) $y = -5$
- (D) $y = 5$

11. What is the range of the function in the graph below?

- (A) $\{x|x \in R\}$
- (B) $\{x|x \leq 3, x \in R\}$
- (C) $\{y|y \in R\}$
- (D) $\{y|y \leq 0, y \in R\}$



12. Which equation is produced if $y = x^2$ is translated one unit up, eight units right, and is reflected about the x-axis?

- (A) $y = -(x - 8)^2 + 1$
- (B) $y = -(x + 8)^2 - 1$
- (C) $y = (x - 8)^2 + 1$
- (D) $y = (x + 8)^2 - 1$

13. What value of c makes $x^2 + 8x + c$ a perfect square trinomial?

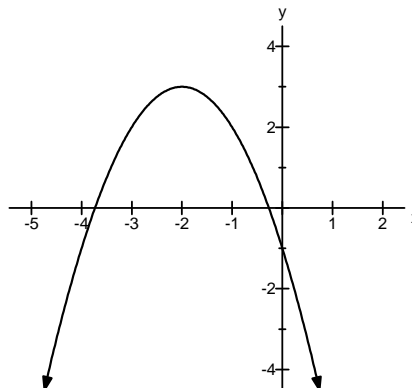
- (A) 4
- (B) 8
- (C) 16
- (D) 64

14. The path of a ball is given by $h(t) = -3t^2 + 12t + 4$, where h represents the height in metres and t represents the time in seconds. At what time, in seconds, does the ball reach its maximum height?

- (A) 2
- (B) 4
- (C) 6
- (D) 12

15. Compared to $y = x^2$, what is the vertical translation of the following graph?

- (A) 2 units left
- (B) 2 units right
- (C) 3 units down
- (D) 3 units up



16. What is the vertex of the quadratic function that has x-intercepts of $(-3,0)$ and $(5,0)$ and a maximum value of 9?

- (A) $(-1, 9)$
- (B) $(1, 9)$
- (C) $(2, 9)$
- (D) $(9, 1)$

17. Which function will have the widest graph?

- (A) $\frac{1}{4}(y + 1) = (x + 1)^2$
- (B) $\frac{1}{2}(y + 1) = (x + 1)^2$
- (C) $2(y + 1) = (x + 1)^2$
- (D) $3(y + 1) = (x + 1)^2$

18. Which function represents the transformation of $y = x^2$, under the mapping rule $(x, y) \rightarrow (x - 5, 3y + 2)$?

- (A) $\frac{1}{3}(y - 2) = (x + 5)^2$
- (B) $\frac{1}{3}(y + 2) = (x - 5)^2$
- (C) $3(y - 2) = (x + 5)^2$
- (D) $3(y + 2) = (x - 5)^2$

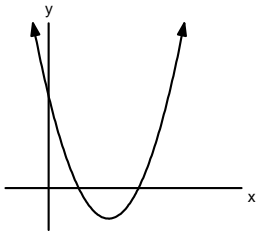
19. What is the vertical stretch of $y = \frac{2}{3}x^2 - 2x + 4$?

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

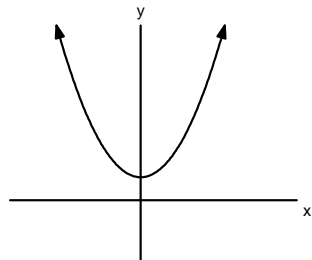
20. The difference of two integers is 12 and the product is a minimum. Which expression represents the product of the integers?
- (A) $x(12x)$
 - (B) $x(x - 12)$
 - (C) $x(12 - x)$
 - (D) $x(-12 - x)$
21. What is the discriminant of $y = x^2 + 4x - 5$?
- (A) -16
 - (B) -4
 - (C) 6
 - (D) 36
22. What is the nature of the roots of the equation $2x^2 - 5x + 3 = 0$?
- (A) imaginary and equal
 - (B) imaginary and unequal
 - (C) real and equal
 - (D) real and unequal
23. What are the x-intercepts of $y = x^2 + 48$?
- (A) $\pm 3\sqrt{2}$
 - (B) $\pm 3i\sqrt{2}$
 - (C) $\pm 4\sqrt{3}$
 - (D) $\pm 4i\sqrt{3}$
24. Which equation has roots $\frac{1}{2}$ and -3 ?
- (A) $2x^2 + 5x - 3 = 0$
 - (B) $2x^2 + 7x + 3 = 0$
 - (C) $2x^2 - 5x - 3 = 0$
 - (D) $2x^2 - 7x + 3 = 0$

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

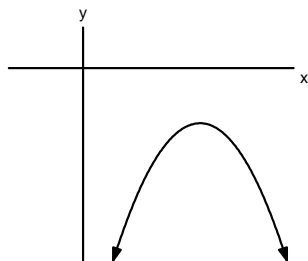
(A)



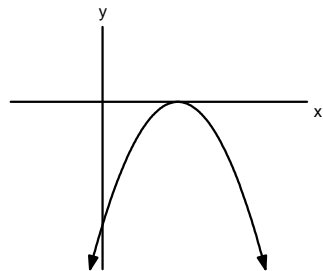
(B)



(C)



(D)



26. For what value(s) of “k” does the equation $y = x^2 + kx + 4$ have 2 equal, real roots?

(A) $b < -4$

(B) $b = 0$

(C) $b = \pm 4$

(D) $b > 4$

27. What are the roots of $2x^2 + 5x = 0$?

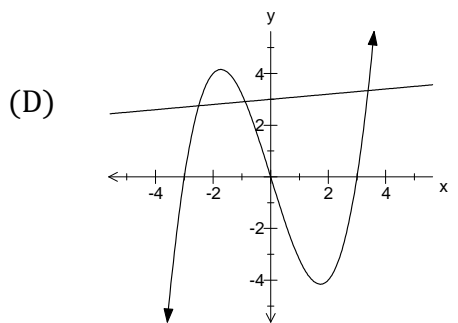
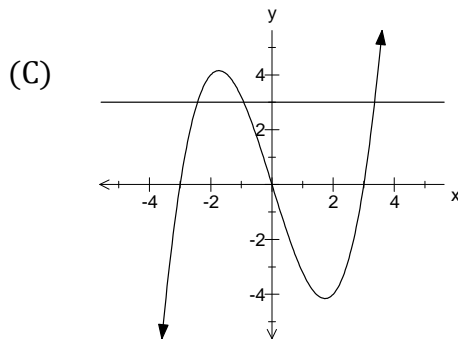
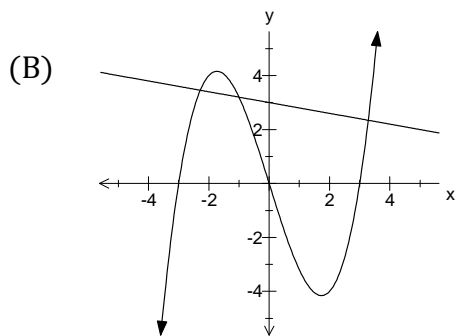
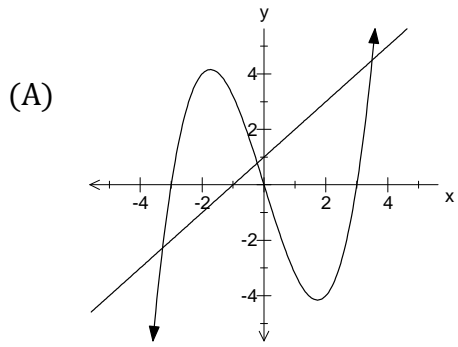
(A) $-\frac{5}{2}, \frac{5}{2}$

(B) $-\frac{5}{2}, 0$

(C) $0, \frac{5}{2}$

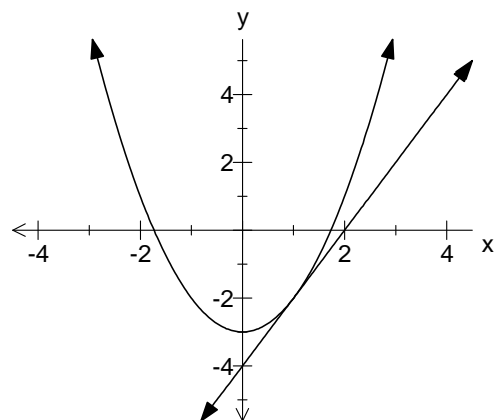
(D) $2, 5$

28. Which secant line below displays the **greatest** average rate of change?



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

- (A) negative average
- (B) negative instantaneous
- (C) positive average
- (D) positive instantaneous



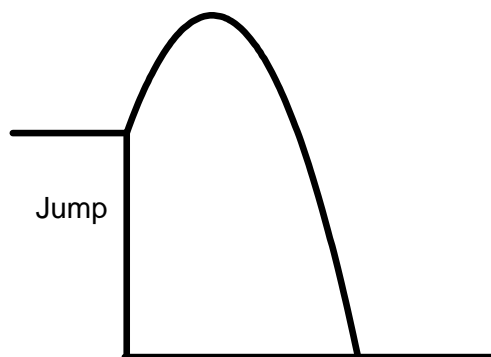
30. Using the data table below, what is the average rate of change from $x = 1$ to $x = 5$?

x	0	1	2	3	4	5
y	5	7	9	11	13	15

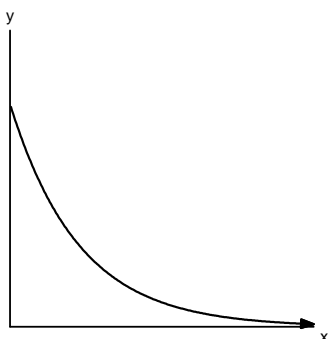
- (A) -2
- (B) $-\frac{1}{2}$
- (C) $\frac{1}{2}$
- (D) 2

31. A snowboarder jumps off a hill in a parabolic path. Her instantaneous rate of change at 2 seconds is 0 m/s. Which statement is true?

- (A) She is at her highest point.
- (B) She is going down.
- (C) She is going up.
- (D) She is just starting her jump.



32. Which real life situation can be modeled by the graph below?

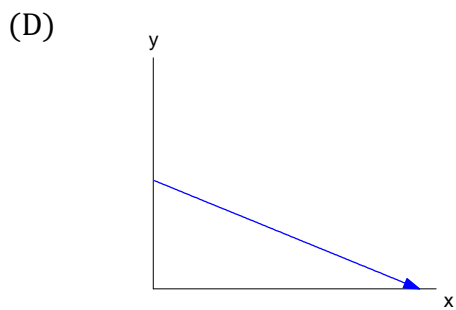
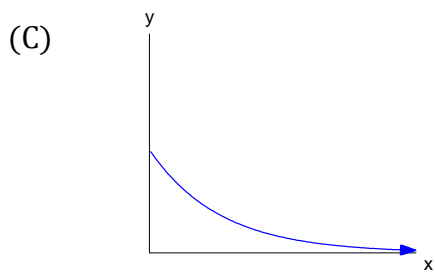
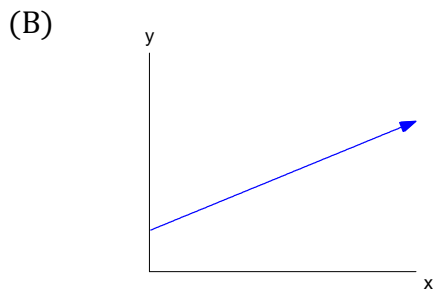
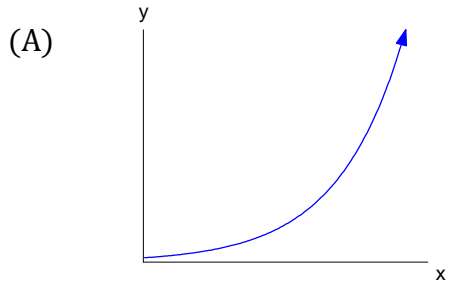


- (A) a ball kicked in the air
- (B) a population of bacteria doubling every hour
- (C) appreciation of the value of a hockey card
- (D) depreciation of the value of a car

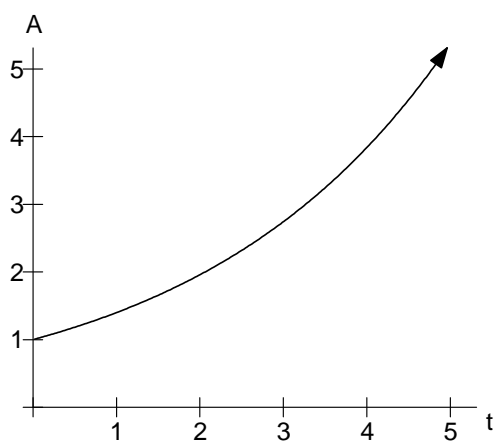
33. Simplify: $\left(\frac{3}{4}\right)^{-2}$

- (A) $-\frac{16}{9}$
- (B) $-\frac{6}{8}$
- (C) $\frac{9}{16}$
- (D) $\frac{16}{9}$

34. Which graph best models an investment of money earning 5% interest per year?



35. What is the **domain** of the function graphed below?



- (A) $\{A|A \geq 1, A \in R\}$
- (B) $\{A|A \in R\}$
- (C) $\{t|t \geq 0, t \in R\}$
- (D) $\{t|t \in R\}$

36. Which equation produces exponential growth?

(A) $y = 4(-1.8)^{\frac{x}{2}}$

(B) $y = 4(-0.8)^{\frac{x}{2}}$

(C) $y = 4(0.4)^{\frac{x}{2}}$

(D) $y = 4(1.8)^{\frac{x}{2}}$

37. What is the equation of the horizontal asymptote for the graph of $y = 5(4)^x - 8$?

(A) $y = -8$

(B) $y = -4$

(C) $y = 5$

(D) $y = 8$

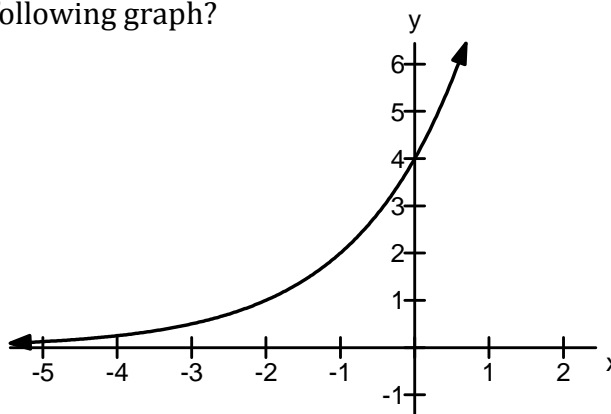
38. Which equation models the following graph?

(A) $y = 2^x$

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

(C) $y = 3(2)^x$

(D) $y = 4(2)^x$



39. What is the range of $y = 4(3)^x + 2$?

(A) $\{y|y > 2, y \in R\}$

(B) $\{y|y \geq 2, y \in R\}$

(C) $\{y|y < 2, y \in R\}$

(D) $\{y|y \leq 2, y \in R\}$

40. How cold is it outdoors if an engine is cooling according to the function

$T = 104\left(\frac{1}{2}\right)^{\frac{t}{15}} + 13$, where T is temperature ($^{\circ}\text{C}$) and t is time in minutes?

(A) 13

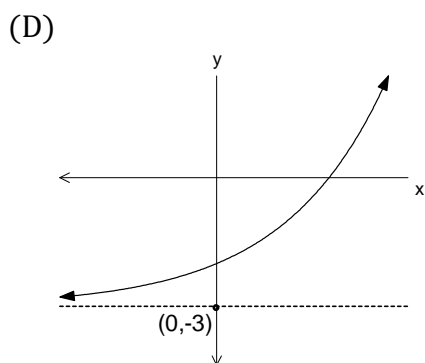
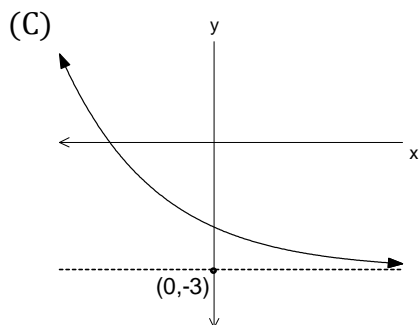
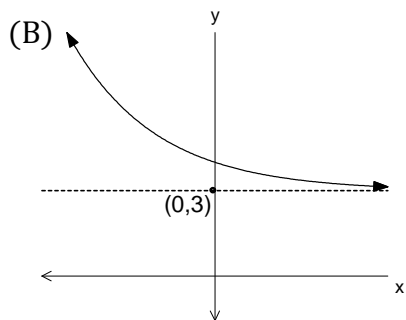
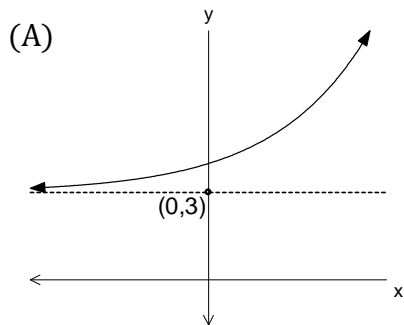
(B) 15

(C) 104

(D) 117

41. Which function models exponential decay with a horizontal asymptote of $y = 10$?
- (A) $y = 4\left(\frac{1}{3}\right)^x + 10$
- (B) $y = 4(3)^x + 10$
- (C) $y = 10\left(\frac{1}{3}\right)^x + 4$
- (D) $y = 10(3)^{x+4}$
42. Which function below is growing at the fastest rate?
- (A) $y = (-2)^x$
- (B) $y = \left(\frac{1}{2}\right)^x$
- (C) $y = 4^x$
- (D) $y = 7^x$
43. A snowmobile was bought for \$18 000. It depreciates at a rate of 25% every two years. Which function models the value (V) of the snowmobile after t years?
- (A) $V = 18\,000(0.75)^{\frac{t}{2}}$
- (B) $V = 18\,000(0.75)^{2t}$
- (C) $V = 18\,000(1.25)^{\frac{t}{2}}$
- (D) $V = 18\,000(1.25)^{2t}$
44. What is the common ratio for $\{2, -6, 18, -54, 162, \dots\}$?
- (A) -3
- (B) $-\frac{1}{3}$
- (C) $\frac{1}{3}$
- (D) 3
45. What is the y-intercept of $y = 3(2)^x - 1$?
- (A) $(0, -1)$
- (B) $(0, 2)$
- (C) $(0, 3)$
- (D) $(0, 5)$

46. Which graph represents the equation $y = b^x - 3$ where $0 < b < 1$?



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

(A) $\frac{8}{27}$

(B) $\frac{27}{8}$

(C) 8

(D) 9

48. Which equation represents the following data?

x	0	2	4	6	8
y	0.5	1.5	4.5	13.5	40.5

- (A) $y = \frac{1}{2} \left(\frac{1}{3}\right)^{\frac{x}{2}}$
- (B) $y = \frac{1}{2} \left(\frac{1}{3}\right)^{2x}$
- (C) $y = \frac{1}{2} (3)^{\frac{x}{2}}$
- (D) $y = \frac{1}{2} (3)^{2x}$
49. A sample of carbon decays according to the formula $A = 10 \left(\frac{1}{2}\right)^{\frac{t}{5750}}$, where A is the amount in grams and t is the time in years. How much carbon, in grams, will be left after 11 500 years?
- (A) 0.5
- (B) 2.5
- (C) 10
- (D) 25
50. A population of bacteria is growing according to the formula $P = 400(3)^{\frac{t}{20}} + 50$, where P is the number of bacteria and t is the time in minutes. How many bacteria were in the sample **originally**?
- (A) 50
- (B) 400
- (C) 450
- (D) 1250

PART II

Total Value 50%

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

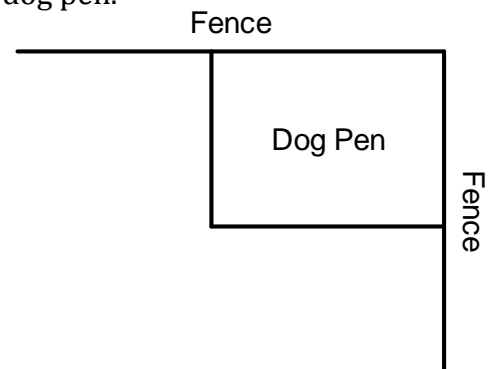
Value

4 51. Algebraically determine the **EXACT** roots, in simplest form, of $x(x - 3) = -9$.

4 52. Change the equation $y = 4x^2 + 16x + 70$ into transformational form.

Value

- 4 53. You want to construct a dog pen, which has an area of $60m^2$, in the corner of your fenced-in backyard. If the length is $7m$ more than the width, **algebraically** determine the dimensions of the dog pen.

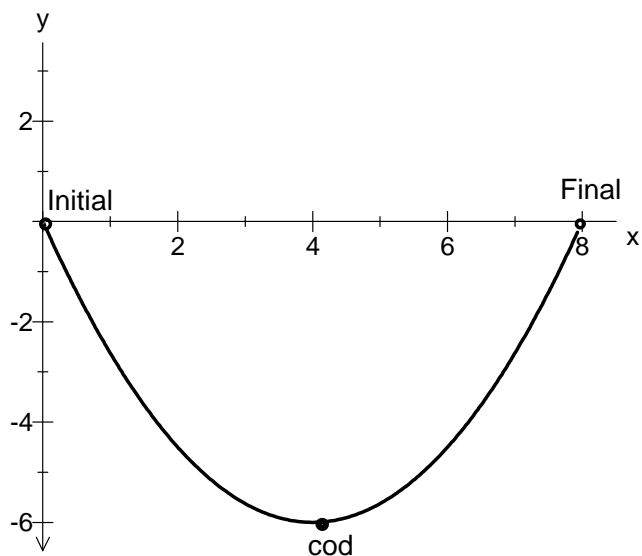


- 4 54. The difference of two numbers is 10. The sum of their squares is a minimum. **Algebraically** determine the two numbers.

Value

- 4 55. A volleyball player is serving the ball and the ball follows a parabolic path that is described by the function $h(t) = -8t^2 + 8t + 1$, where t is the time in seconds and h is the height in metres. **Algebraically** determine the maximum height of the volleyball and the time at which the maximum height occurs.

- 4 56. A seal dives beneath the surface of the ocean to catch a codfish 6 m below the water. **Algebraically** determine the quadratic function if the seal resurfaces 8m away from its initial position.



Value

- 4 57. A cannonball is launched into the air. It follows a parabolic path described by the function $h(t) = -2t^2 + 20t + 3$, where t is the time in seconds and $h(t)$ is the height in metres. **Algebraically** determine the time(s) when the cannonball is at a height of 45 m.
- 4 58. The amount of medicine in your blood stream is modeled by $A = 40(0.8)^t$ where A is the amount of medicine in mg and t is the time in hours. Algebraically determine the average rate of change in the amount of medicine in your bloodstream between 3 hours and 5 hours.

Value

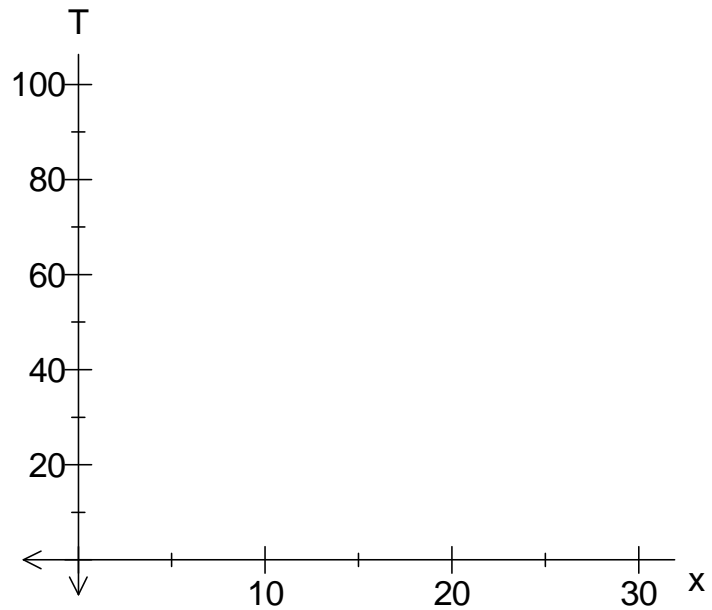
- 4 59. The height, h (in metres), of a ball is given by the equation $h = -4.9t^2 + 30t$ where t is the time in seconds after the ball is hit. Algebraically determine the instantaneous rate of change in the ball's height above the ground at 2.0 s.

- 3 60. A person invests \$500. It doubles in value every 6 years. Algebraically determine how much his investment is worth in 42 years.

Value

- 3 61. A Delissio Pizza is taken out of the oven and laid on the kitchen table to cool. Its temperature is modeled by $T = 80(0.75)^{\frac{x}{3}} + 20$, where T is the temperature in degrees Celsius and x is the time in minutes. Complete the table of values for the first 30 minutes and sketch the graph, including the asymptote.

x	T
0	
5	
10	
15	
20	
25	
30	



- 4 62. A snowmobile was purchased in 1998 and depreciated by 12% every 3 years. If the value of the snowmobile in 2010 is \$7196, what was the original value of the snowmobile?

Value

- 4 63. The table below shows the number of salmon counted on Harry's River over a period of time. Algebraically determine an equation that models the number of salmon, n , over time, t . Use the equation to predict the salmon population after 32 years.

Time (t) in years	0	4	8	12	16
Number of salmon, n	10 000	5000	2500	1250	625