

**STUDENT'S NAME**

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**TEACHER'S NAME**

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



**MIDYEAR EXAMINATION  
MATHEMATICS 3204**

**January 29, 2008**

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. A self-powered calculator may be used for calculations and to obtain special values.
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.

## Teacher Grading Sheet ( PART I )

- |           |           |
|-----------|-----------|
| 1. _____  | 26. _____ |
| 2. _____  | 27. _____ |
| 3. _____  | 28. _____ |
| 4. _____  | 29. _____ |
| 5. _____  | 30. _____ |
| 6. _____  | 31. _____ |
| 7. _____  | 32. _____ |
| 8. _____  | 33. _____ |
| 9. _____  | 34. _____ |
| 10. _____ | 35. _____ |
| 11. _____ | 36. _____ |
| 12. _____ | 37. _____ |
| 13. _____ | 38. _____ |
| 14. _____ | 39. _____ |
| 15. _____ | 40. _____ |
| 16. _____ | 41. _____ |
| 17. _____ | 42. _____ |
| 18. _____ | 43. _____ |
| 19. _____ | 44. _____ |
| 20. _____ | 45. _____ |
| 21. _____ | 46. _____ |
| 22. _____ | 47. _____ |
| 23. _____ | 48. _____ |
| 24. _____ | 49. _____ |
| 25. _____ | 50. _____ |

**Student's Name:**

\_\_\_\_\_

**Teacher's Name:**

\_\_\_\_\_

**PART I**  
**Total Value: 50%**

Answer all items. Shade the letter of the correct answer on the computer scorable answer sheet and write the correct letter in the answer sheet as directed by your teacher. All items on Part I have a value of one mark.

1. For the sequence defined by  $t_n = -2n^2 + 5n - 7$ , what is the value of  $t_{10}$ ?

- (A) -157
- (B) -97
- (C) -17
- (D) 343

2. Building blocks are stacked as shown. If this pattern is continued, which type of function will model the number of blocks?



Fig 1

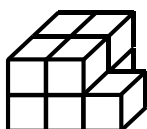


Fig 2

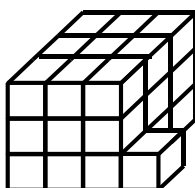


Fig 3

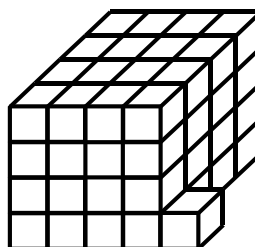


Fig 4

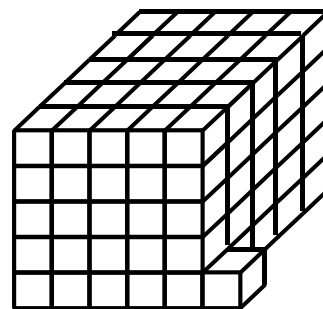


Fig 5

- (A) Cubic
- (B) Exponential
- (C) Linear
- (D) Quadratic

3. Which of the following represents an arithmetic sequence?

- (A)  $t_n = 3 + 5n$
- (B)  $t_n = 3 + 2n^3$
- (C)  $t_n = 8 - \frac{5}{n}$
- (D)  $t_n = 5n^2 - 2n + 7$

4. What is the second level difference for the sequence generated by  $t_n = 5n + 3n^2$ ?

- (A) 3
- (B) 5
- (C) 6
- (D) 10

5. The table shows the particles of dust released by an engine at different speeds. Which type of function models this data?

Speed (km/h)	10	20	30	40	50
Particles (ppm)	12	27	52	87	132

- (A) Cubic
- (B) Exponential
- (C) Linear
- (D) Quadratic

6. Which formula generates the sequence  $\{ -2, 3, 8, 13, \dots \}$ ?

(A)  $t_n = n - 2$

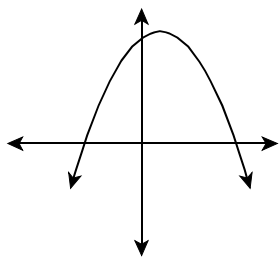
(B)  $t_n = n - 7$

(C)  $t_n = 5n - 2$

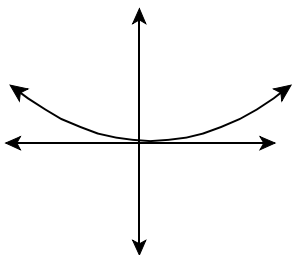
(D)  $t_n = 5n - 7$

7. Which of the graphs will have an equation with the smallest vertical stretch factor when compared to  $y = x^2$ ?

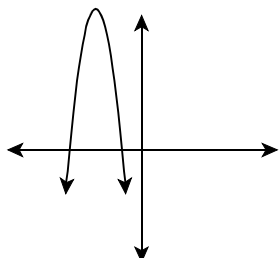
(A)



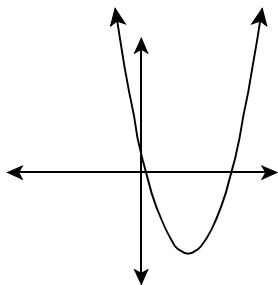
(B)



(C)



(D)



8. Which equation is produced if  $y = x^2$  is translated 2 units to the left, 4 units up and stretched vertically by a factor of 5?

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

(B)  $\frac{1}{5}(y + 4) = (x + 2)^2$

(C)  $5(y - 4) = (x + 2)^2$

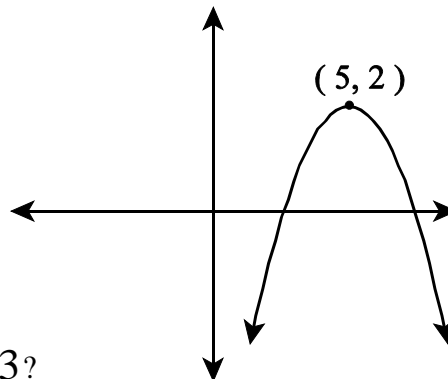
(D)  $5(y + 4) = (x - 2)^2$

9. What is the general form of  $\frac{1}{3}(y - 6) = (x - 3)^2$  ?

- (A)  $y = 3x^2 + 33$
- (B)  $y = \frac{1}{3}x^2 - 2x + 9$
- (C)  $y = 3x^2 - 18x + 33$
- (D)  $y = 3(x - 3)^2 + 6$

10. Which equation corresponds to the graph ?

- (A)  $y = -2(x - 5)^2 - 2$
- (B)  $y = -2(x - 5)^2 + 2$
- (C)  $y = 2(x - 5)^2 - 2$
- (D)  $y = 2(x - 5)^2 + 2$

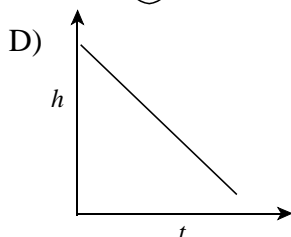
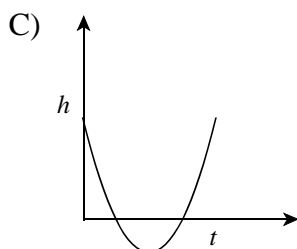
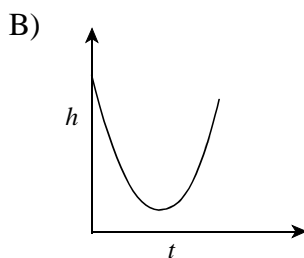
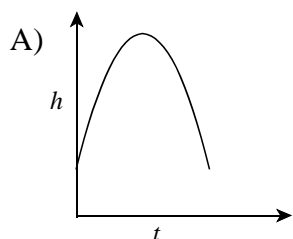


11. What is the range of  $y = -2(x - 7)^2 + 3$  ?

- (A)  $\{y \mid y \leq -3, y \in R\}$
- (B)  $\{y \mid y \geq -3, y \in R\}$
- (C)  $\{y \mid y \leq 3, y \in R\}$
- (D)  $\{y \mid y \geq 3, y \in R\}$

12. Which graph could model the following situation?

“A weight attached to an elastic band is dropped and nearly reaches the floor. The height of the weight is measured over time.”



13. What is the equation of the axis of symmetry for  $y = 3(x + 5)^2 + 7$ ?

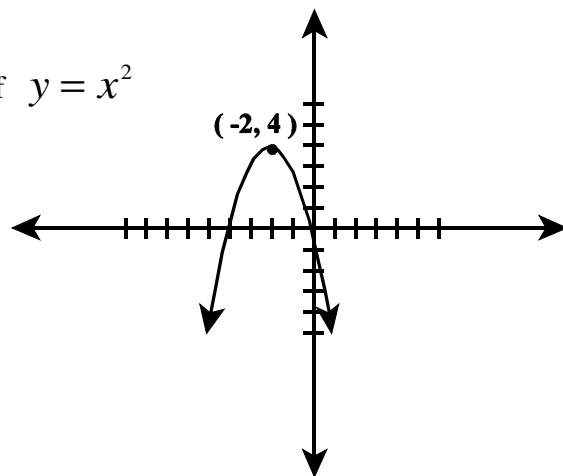
- (A)  $x = -5$
- (B)  $x = 5$
- (C)  $y = -5$
- (D)  $y = 5$

14. What is the transformational form of  $y = x^2$  under the mapping rule  $(x, y) \rightarrow (x + 2, \frac{1}{4}y - 1)$ ?

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

15. Which mapping rule would transform the graph of  $y = x^2$  to the graph shown?

- (A)  $(x, y) \rightarrow (x + 2, -y - 4)$
- (B)  $(x, y) \rightarrow (x + 2, y - 4)$
- (C)  $(x, y) \rightarrow (x - 2, -y + 4)$
- (D)  $(x, y) \rightarrow (x - 2, y + 4)$



16. What are the coordinates of the vertex for the quadratic function having a minimum value of 10 and  $x$ -intercepts located at  $(-2, 0)$  and  $(4, 0)$ ?

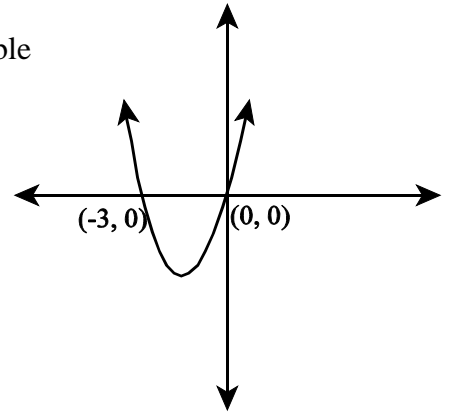
- (A)  $(1, 10)$
- (B)  $(10, 1)$
- (C)  $(1, 0)$
- (D)  $(10, 0)$

17. Which value of “ $c$ ” makes  $x^2 - 9x + c$  a perfect square?

- (A)  $-\frac{81}{4}$
- (B)  $-\frac{9}{2}$
- (C)  $\frac{9}{4}$
- (D)  $\frac{81}{4}$

18. If the graph of the quadratic  $f(x)$  is shown, which is a possible value(s) of the discriminant for the equation  $f(x) = 0$ ?

- (A) -3
- (B) -3, 0
- (C) 0
- (D) 5



19. Solve:  $2x^2 + 24 = 0$

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

20. If  $x = -2$  is one root of the equation  $2x^2 + bx + 6 = 0$ . What is the value of  $b$ ?

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

21. The motion of an arrow shot from a tree is modeled by the equation  $h(t) = -5t^2 + 8t + 3$ . What is the initial height of the arrow?

- (A) -5
- (B) 0
- (C) 2
- (D) 3

22. What is the value of the discriminant of the equation  $2x^2 - \sqrt{5}x + 3 = 0$ ?

- (A) -29
- (B) -19
- (C)  $i\sqrt{19}$
- (D)  $i\sqrt{29}$

23. Which best describes the nature of the roots of  $y = 2x^2 + 3x + 6$ ?

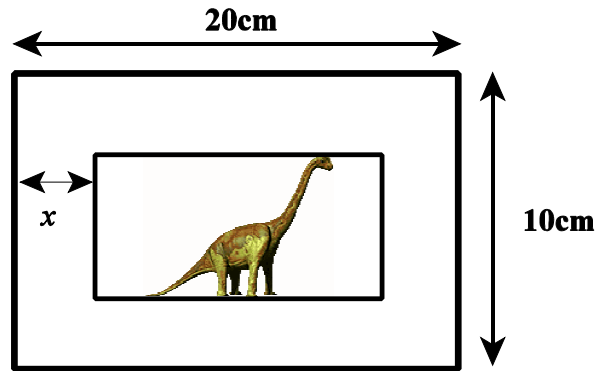
- (A) Two equal real roots
- (B) Two unequal real roots
- (C) Two equal imaginary roots
- (D) Two unequal imaginary roots

24. What are the zeros for the quadratic function  $y = (x + 3)(2x - 1)$ ?

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

25. A picture of a dinosaur has a uniform strip of width  $x$  around it. Which is an expression for the area ( $A$ ) of the picture?

- (A)  $A = (20 - 2x)(10 - 2x)$   
 (B)  $A = (20 - x)(10 - x)$   
 (C)  $A = (20 + 2x)(10 + 2x)$   
 (D)  $A = (20 + x)(10 + x)$



26. Which equation has roots -3 and 5 ?

- (A)  $x^2 - 8x + 15 = 0$   
 (B)  $x^2 + 2x - 15 = 0$   
 (C)  $x^2 - 2x - 15 = 0$   
 (D)  $x^2 + 8x + 15 = 0$

27. Simplify:  $\frac{6 \pm \sqrt{-40}}{2}$

- (A)  $3 \pm \sqrt{-40}$   
 (B)  $3 \pm i\sqrt{10}$   
 (C)  $3 \pm \sqrt{-20}$   
 (D)  $3 \pm 2i\sqrt{10}$

28. Between which months was the average rate of change in the value of the Canadian dollar the greatest?



- (A) July - September  
 (B) March - May  
 (C) May - July  
 (D) September - November



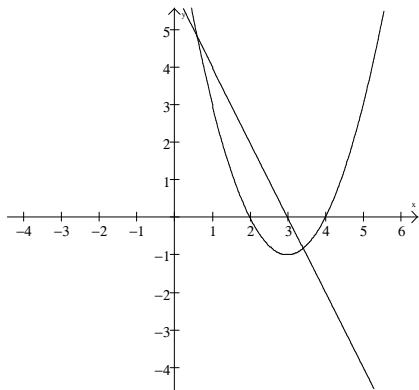
29. What is the average rate of change in metres per second, between 1 and 4 seconds?

Time ( $s$ )	0	1	2	3	4	5
Distance ( $m$ )	0	5	10	13	17	20

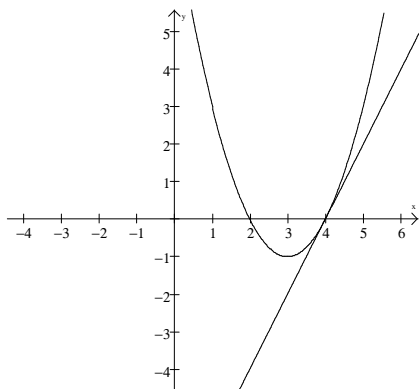
- (A) - 4
- (B) 0.25
- (C) 3
- (D) 4

30. Which graph best illustrates a positive instantaneous rate of change?

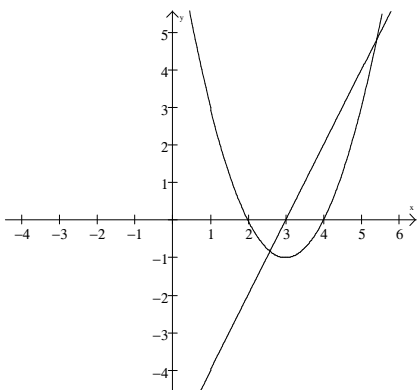
(A)



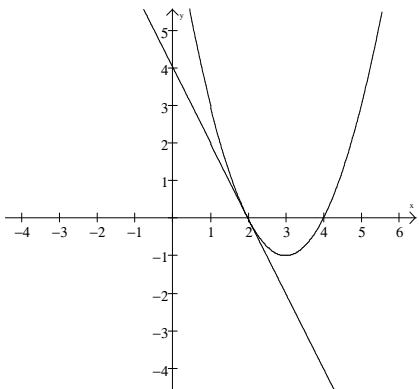
(B)



(C)



(D)



31. The table shows the height  $h(t)$  of a ski jumper, in metres, over time  $(t)$ , in seconds. Based on this data, what is the best approximation for the instantaneous rate of change, in metres per second, at 1.5 seconds?

<b>t</b>	1.48	1.49	1.50	1.51	1.52
<b>h(t)</b>	12.027	12.002	11.975	11.948	11.919

- (A) -2.70  
 (B) -0.37  
 (C) 0.13  
 (D) 11.975
32. What is the common ratio between the successive terms of the sequence generated by  $t_n = 7\left(\frac{1}{3}\right)^n$ ?

- (A)  $\frac{1}{7}$   
 (B)  $\frac{1}{3}$   
 (C) 3  
 (D) 7

33. Which represents a geometric sequence?

(A)

<b>x</b>	1	2	3	4
<b>y</b>	6	18	54	162

(B)

<b>x</b>	1	2	3	4
<b>y</b>	5	11	19	29

(C)

<b>x</b>	1	2	3	4
<b>y</b>	8	5	$\frac{7}{2}$	$\frac{11}{4}$

(D)

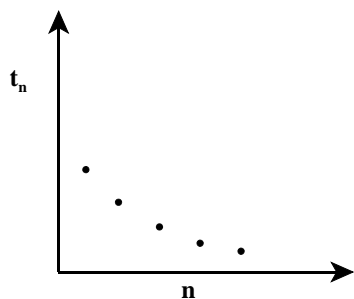
<b>x</b>	1	2	3	4
<b>y</b>	37	40	43	46

34. What type of sequence is  $\left\{1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots\right\}$ ?

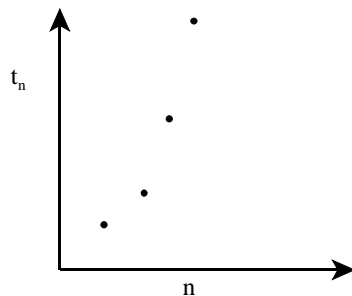
- (A) Arithmetic  
 (B) Cubic  
 (C) Geometric  
 (D) Quadratic

35. Which graph best represents the sequence  $t_n = 3\left(\frac{1}{2}\right)^n$  ?

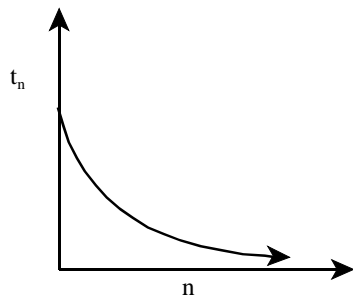
(A)



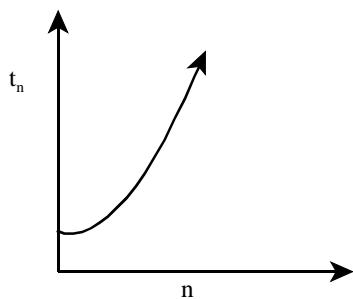
(B)



(C)



(D)



36. Which situation is best modeled by an exponential relationship?

- (A) The height of a soccer ball from ground level over time.
- (B) The distance traveled by a car moving at  $90 \text{ km/h}$  over time.
- (C) The temperature of a loaf of bread taken from a hot oven over time
- (D) The volume of a balloon as it is being filled with air at a constant rate over time.

37. Which function produces an exponential growth curve?

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

38. Simplify:  $(3^{-2} + 3^{-1})^2$

- (A)  $\frac{1}{729}$
- (B)  $\frac{1}{36}$
- (C)  $\frac{10}{81}$
- (D)  $\frac{16}{81}$

39. Which exponential function best represents the data?

$x$	-4	-2	0	2	4
$y$	1458	162	18	2	$\frac{2}{9}$

- (A)  $y = 1458\left(\frac{1}{9}\right)^{\frac{x}{2}}$
- (B)  $y = 18\left(\frac{1}{9}\right)^{\frac{x}{2}}$
- (C)  $y = 1458\left(\frac{1}{9}\right)^x$
- (D)  $y = 18\left(\frac{1}{9}\right)^x$

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

- (A)  $\{y \mid y > -2, y \in R\}$
- (B)  $\{y \mid y > 2, y \in R\}$
- (C)  $\{y \mid y > 3, y \in R\}$
- (D)  $\{y \mid y > 4, y \in R\}$

41. The graph of which function is decreasing at a faster rate from  $x = -2$  to  $x = 3$ ?

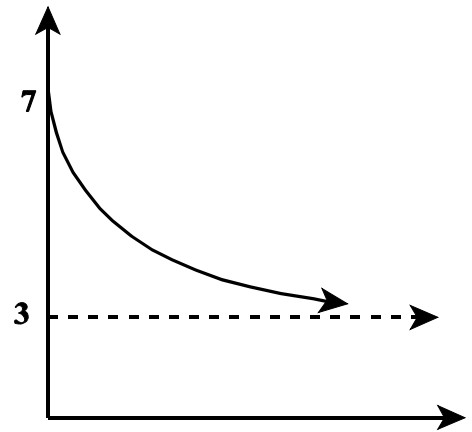
- (A)  $y = \left(\frac{1}{5}\right)^x$
- (B)  $y = \left(\frac{1}{3}\right)^x$
- (C)  $y = 3^x$
- (D)  $y = 5^x$

42. An antiseptic is applied to a bacterial culture with an initial population of 800 bacteria. If the population decreases 12% every 2 minutes, which equation describes the number of bacteria ( $y$ ) remaining after ( $x$ ) minutes?

- (A)  $y = 800(0.12)^{\frac{x}{2}}$
- (B)  $y = 800(0.12)^{2x}$
- (C)  $y = 800(0.88)^{\frac{x}{2}}$
- (D)  $y = 800(0.88)^{2x}$

43. Which statement best describes the graph shown?

- (A) A decay curve with a horizontal asymptote at  $y = 7$ .
- (B) A decay curve with a horizontal asymptote at  $y = 3$ .
- (C) A growth curve with a horizontal asymptote at  $y = 7$ .
- (D) A growth curve with a horizontal asymptote at  $y = 3$ .



44. What is the equation of the asymptote of the graph of  $y = 3(5)^x + 2$ ?

- (A)  $x = 0$
- (B)  $x = 2$
- (C)  $y = 0$
- (D)  $y = 2$

45. Solve for  $x$ :  $100^x = 10^{-3x+20}$

- (A) - 20
- (B) - 4
- (C) 4
- (D) 5

46. What is the y-intercept of  $2(y - 1) = 3^x$ ?

- (A) - 1
- (B) 1
- (C) 1.5
- (D) 3

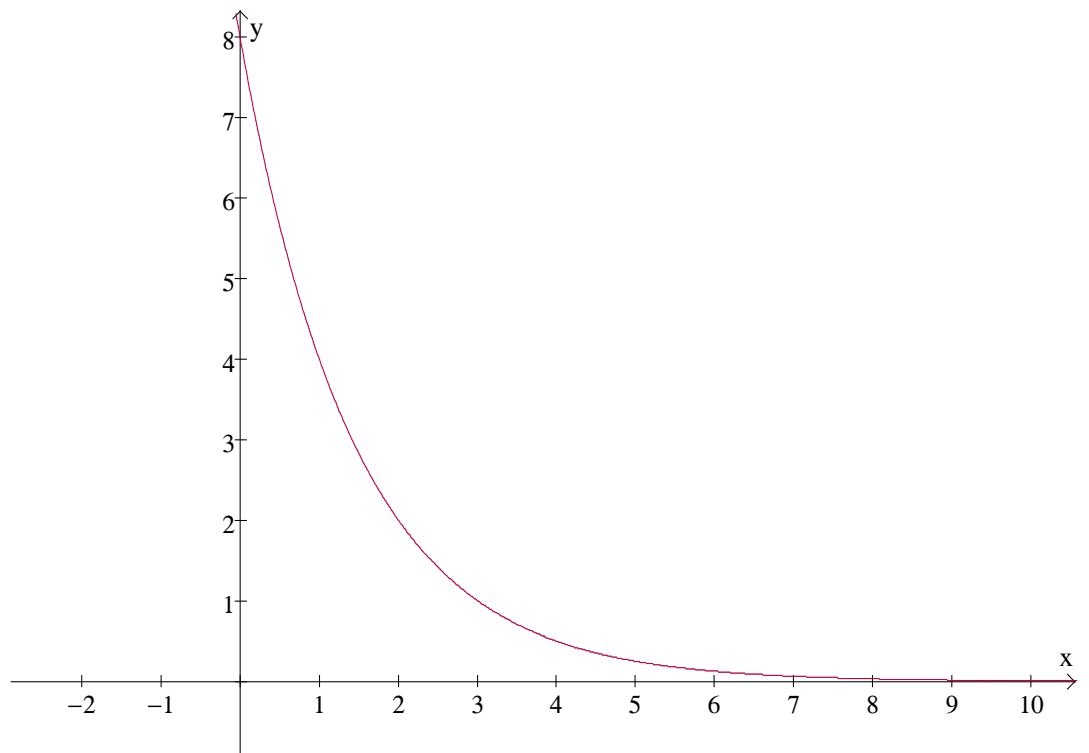
47. Hot lava ejected from a volcano cools according to the formula

$T(h) = 3000(0.35)^h + 25$ , where  $T(h)$  is the temperature in degrees Celsius and  $h$  is the time in hours. What is the initial temperature of the lava the instant it was ejected from the volcano?

- (A) 1075 °C
- (B) 2975 °C
- (C) 3000 °C
- (D) 3025 °C

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

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



49. If  $f(x) = 4^{-2x+1} + 6$ , find  $f\left(-\frac{1}{2}\right)$

- (A) 6
- (B) 7
- (C) 11
- (D) 22

50. The decay of radioactive active substance is modeled by the equation

$f(x) = 6\left(\frac{1}{2}\right)^{\frac{x}{10}}$ , where  $x$  is the time in years and  $f(x)$  is the amount of substance remaining. What is the half-life of the substance?

- (A)  $\frac{1}{10}$
- (B)  $\frac{1}{6}$
- (C) 3
- (D) 10

**PART II**  
**Total Value 50%**

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

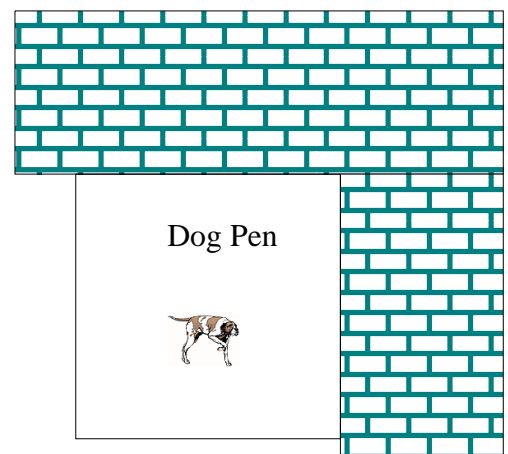
*Value*

4    51.    Algebraically determine the **EXACT** roots in simplest form for  $\frac{3x}{x-3} = \frac{2}{x+4}$

4    52.    Change  $y = 3x^2 - 12x + 17$  to standard form.

- 4 53. A parabola has vertex  $(1,7)$  and passes through the point  $(3,-1)$ . Write the equation of the parabola in transformational form.

- 4 54. Sue has  $12m$  of fencing to make a rectangular dog pen in the corner of a building (as shown in the diagram.) Algebraically determine the dimensions of the dog pen that would yield the maximum area.





- 4 55. Two consecutive even numbers have a product of 360. Write a quadratic equation and use it to find the numbers.
- 4 56. The path of a toy rocket is modeled by  $h(t) = -5t^2 + 50t + 6$ , where  $h(t)$  represents the height above the ground, in metres, and  $t$  represents the time, in seconds, after it is launched. Algebraically determine the time the rock reached its maximum height and this height?

- 4 57. The length of a rectangular garden is  $20m$  more than 4 times its width ( $x$ ). If the area of the garden is  $144m^2$ , write a quadratic equation to represent the area and use it to find the dimensions of the rectangle.



- 4 58. A rock is tossed into a pond. The formula for the area of the circular wave is given by  $A = \pi r^2$ . Calculate the average rate of change in the area when the radius increases from  $2m$  to  $3m$ .

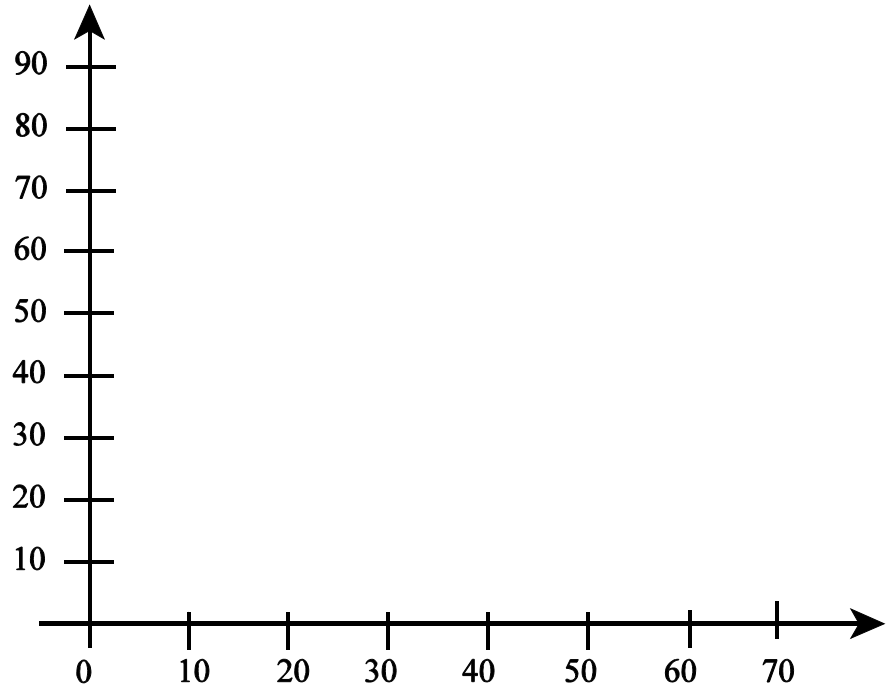
- 4 59. A snowball is thrown into the air. The snowball's height,  $h(t)$ , in metres,  $t$  seconds after it is thrown is modeled by  $h(t) = -5t^2 + 20t + 2$ . What is the approximate instantaneous rate of change of the snowball's height at 2.0 seconds? Explain what is happening at that instant.

3 60. Solve for  $x$ :  $\frac{1}{125} = 5^{2x+1}$

- 4 61. In 2005 the value of an antique Ford Mustang was \$24 000. The value of the car is increasing at a rate of 7.5% per year. What will be the value of the car in 2012?

- 3 62. The cooling of a bowl of soup is modeled by  $T = 52(0.87)^{\frac{x}{3}} + 21$ , where  $T$  is the temperature in  $^{\circ}\text{C}$  and  $x$  is the time in minutes. Sketch a labeled graph, including the asymptote, for the first hour.

$x$	$T$
0	
10	
20	
30	
40	
50	
60	



- 4 63. The table shows the population of moose on the Northern Peninsula over a period of time. Determine the equation of the function which models population of moose,  $p$ , over a period of time,  $t$ . Use this equation to approximate the population of moose after 32 years.

Time ( $t$ ) in years	0	5	10	15
Population ( $p$ )	4000	3200	2560	2048