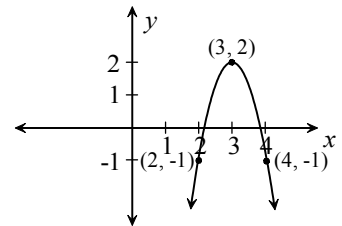


PART I
Total Value: 50%

Answer all items. Shade the letter of the correct answer on the computer scorable answer sheet. All items on Part I have a value of 1 point.

1. What is the vertical stretch factor associated with this graph?

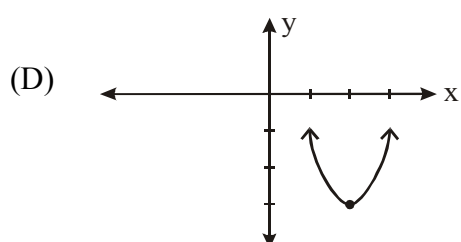
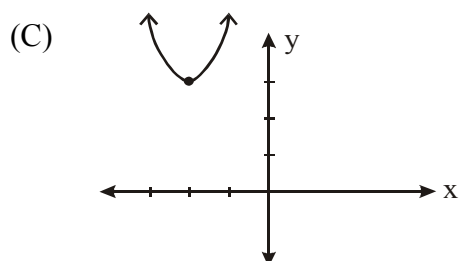
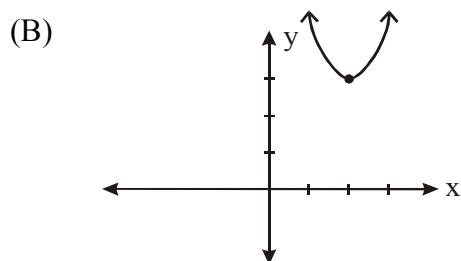
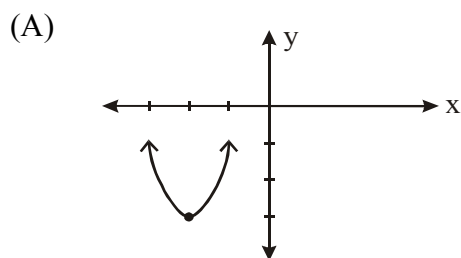
- (A) -3
- (B) $-\frac{1}{3}$
- (C) $\frac{1}{3}$
- (D) 3



2. If the solutions of a quadratic equation are imaginary, which is true about the value of the discriminant?

- (A) $D < 0$
- (B) $D = 0$
- (C) $D > 0$
- (D) D is imaginary

3. Which graph best represents the function $y = (x + 2)^2 - 3$?



4. What is the standard form of the function $\frac{1}{2}(y+1) = (x-3)^2$?

- (A) $y = -2(x-3)^2 - 1$
- (B) $y = -\frac{1}{2}(x-3)^2 - 1$
- (C) $y = 2x^2 - 12x + 17$
- (D) $y = 2(x-3)^2 - 1$

5. Which maps the function $y = x^2$ onto the image $\frac{1}{3}(y+2) = (x-1)^2$?

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

6. What is the value of the discriminant for $3x^2 + 6x - 1 = 0$?

- (A) $\sqrt{24}$
- (B) $\sqrt{48}$
- (C) 24
- (D) 48

7. What is the vertex of the parabola given by $y = x^2 + 4x + 1$?

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

8. What type of function would best model this data?

x	1	2	3	4	5	6
y	4	13	26	43	64	89

- (A) cubic
- (B) exponential
- (C) linear
- (D) quadratic

9. What is the common difference between the successive terms in the sequence generated by $t_n = 5 + \frac{2}{3}n$?

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

10. What are the roots of $x^2 = 5x + 14$?

(A) $\begin{cases} x = -2 \\ x = -7 \end{cases}$

(B) $\begin{cases} x = -7 \\ x = +2 \end{cases}$

(C) $\begin{cases} x = 7 \\ x = -2 \end{cases}$

(D) $\begin{cases} x = 7 \\ x = 2 \end{cases}$

11. Which function describes the sequence $\{4, 10, 16, 22, 28, \dots\}$?

(A) $t_n = -2 + 6n$

(B) $t_n = 2 + 6n$

(C) $t_n = 2 - 6n$

(D) $t_n = 6 - 2n$

12. What are the x -intercepts for the graph of $y = (x)(2x - 1)$?

(A) $1, -\frac{1}{2}$

(B) $1, \frac{1}{2}$

(C) $0, -\frac{1}{2}$

(D) $0, \frac{1}{2}$

13. What transformation of $y = x^2$ results in the equation $3(y + 2) = (x - 6)^2$?

(A) Vertical translation 2 units up, horizontal translation 6 units left, vertical stretch 3

(B) Vertical translation 2 units down, horizontal translation 6 units right, vertical stretch $\frac{1}{3}$

(C) Vertical translation 2 units up, horizontal translation 6 units left, vertical stretch $\frac{1}{3}$

(D) Vertical translation 2 units down, horizontal translation 6 units right, vertical stretch 3

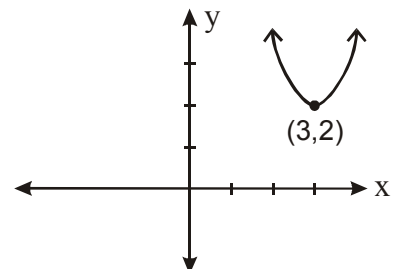
14. What is the range of the function shown?

(A) $\{x \mid x \geq 2, y \in \mathbf{R}\}$

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

(C) $\{x \mid x \geq 3, y \in \mathbf{R}\}$

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



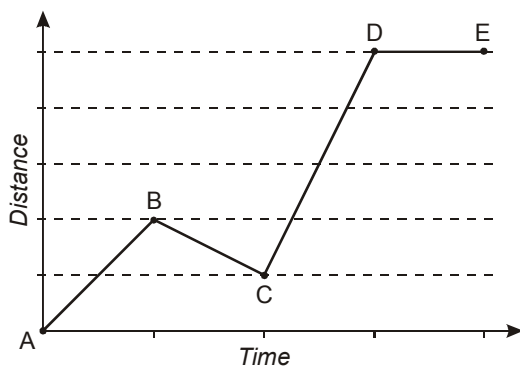
15. What is the value of t_5 in the sequence defined by $t_n = -3n^2 + 1$?

- (A) -78
- (B) -76
- (C) -74
- (D) 5

16. What value of 'c' makes $x^2 + 7x + c$ a perfect square?

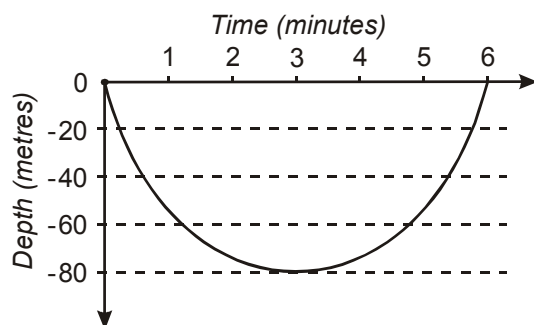
- (A) $\frac{7}{2}$
- (B) 7
- (C) $\frac{49}{4}$
- (D) 49

17. Which section of this distance vs. time graph shows the object as stopped?



- (A) A to B
- (B) B to C
- (C) A to E
- (D) D to E

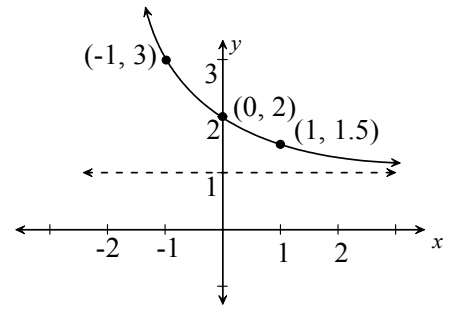
18. The path of a submarine submerging and then resurfacing is given by the graph. What is the average rate of change of depth of the submarine in metres per minute between $t = 4$ mins and $t = 5$ mins?



- (A) -20
- (B) $-\frac{1}{20}$
- (C) $\frac{1}{20}$
- (D) 20

19. Which function best represents the graph?

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



20. What is the equation of the horizontal asymptote for $y = 3(4)^x + 2$?

- (A) $y = 2$
- (B) $y = 3$
- (C) $y = 4$
- (D) $y = 5$

21. Which function produces a decay curve?

- (A) $y = \left(\frac{5}{7}\right)^x$
- (B) $y = \left(\frac{7}{5}\right)^x$
- (C) $y = 1.4^x$
- (D) $y = \frac{1}{2}(3)^x$

22. What is the range of the function $y = 3(2)^x + 1$?

- (A) $\{y \mid y > 1, y \in \mathbf{R}\}$
- (B) $\{y \mid y \geq 1, y \in \mathbf{R}\}$
- (C) $\{x \mid x > 4, y \in \mathbf{R}\}$
- (D) $\{x \mid x \in \mathbf{R}\}$

23. Ralph buys a new house valued at \$90 000. If the value of the house increases by 4% every 3 years, which equation best models the value of the house in terms of the number of years since it was purchased?

- (A) $y = 90000(1.40)^{\frac{x}{3}}$
- (B) $y = 90000(1.04)^x$
- (C) $y = 90000(1.04)^{3x}$
- (D) $y = 90000(1.04)^{\frac{x}{3}}$

24. What is the inverse of the function $y = 4^x$?

- (A) $y = \log_4 x$
- (B) $y = \log_x 4$
- (C) $x = \log_4 y$
- (D) $x = \log_y 4$

25. Which sequence represents an exponential function?

(A) $\{1, 3, 5, 7, 9, \dots\}$

(B) $\{1, 4, 9, 16, 25, \dots\}$

(C) $\{1, 3, 9, 27, 81, \dots\}$

(D) $\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \dots\}$

26. What is the value of $(3^0 + 4^{-1})^{-2}$?

(A) $\frac{16}{169}$

(B) $\frac{16}{25}$

(C) $\frac{25}{16}$

(D) 4

27. What is the simplified form of $\frac{(2x^2)^3}{4x^{-2}}$?

(A) $2x^3$

(B) $2x^4$

(C) $\frac{1}{2}x^8$

(D) $2x^8$

28. What is the value of x in the equation $3^{2x} = \frac{1}{9}$?

(A) -2

(B) -1

(C) 0

(D) 1

29. Which function describes this data?

x	-2	0	2	4	6
y	$\frac{3}{5}$	3	15	75	375

(A) $y = \frac{3}{5}(5)^x$

(B) $y = \frac{3}{5}(5)^{\frac{x}{2}}$

(C) $y = 3(5)^x$

(D) $y = 3(5)^{\frac{x}{2}}$

30. Which represents $3 \log A + 3 \log B - \log C$ written as a single logarithm?

- (A) $3 \log \frac{AB}{C}$
- (B) $\log \frac{A^3 B^3}{C}$
- (C) $3 \log(AB - C)$
- (D) $\log \left(\frac{AB}{C} \right)^3$

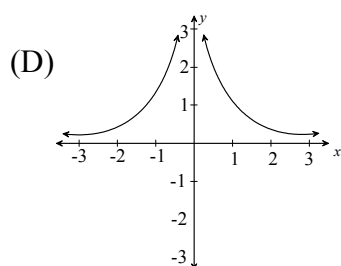
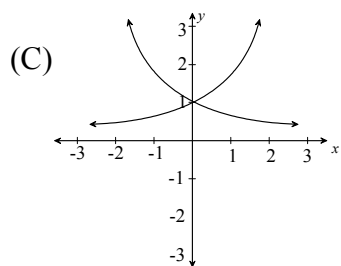
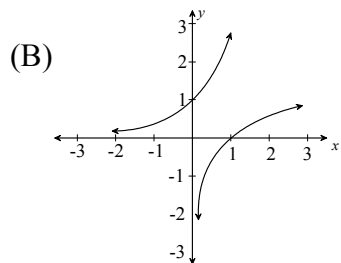
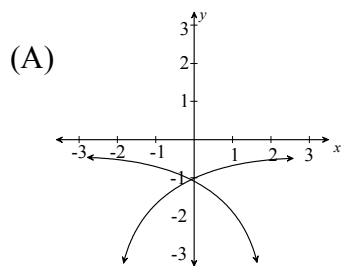
31. Solve for x : $5^x = 7$

- (A) 0.8
- (B) 1.0
- (C) 1.2
- (D) 1.4

32. What are the coordinates of the y -intercept of the function $y = 20(1.8)^x + 3.4$?

- (A) (0, 1.8)
- (B) (0, 3.4)
- (C) (0, 20)
- (D) (0, 23.4)

33. Which pair of graphs illustrates a function and its inverse?



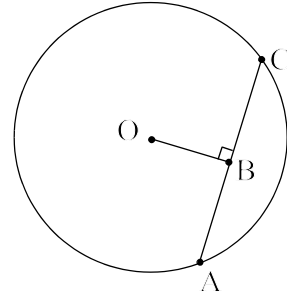
34. What is the value of x in the equation $(\log_3 x) + 1 = -2$?
- (A) $-\frac{8}{9}$
(B) $\frac{1}{27}$
(C) 8
(D) 27
35. What is the value of $(\frac{8}{27})^{-\frac{4}{3}}$?
- (A) $-\frac{16}{81}$
(B) $\frac{16}{3}$
(C) $\frac{16}{81}$
(D) $\frac{81}{16}$
36. Given $f(x) = 4^{-3x+1} - 2$, what is the value of $f(\frac{1}{3})$?
- (A) -2
(B) -1
(C) 2
(D) 14
37. What is the length of the major axis of the ellipse: $[\frac{1}{3}(x+4)]^2 + [\frac{1}{2}(y-1)]^2 = 1$?
- (A) 3
(B) 4
(C) 6
(D) 9
38. Which is the converse of this statement:
“If a triangle is equiangular, then it is equilateral.”
- (A) If a triangle is equiangular, then all its angles are equal.
(B) If a triangle is equilateral, then all its sides are equal.
(C) If a triangle is equiangular, then all its angles are 60° .
(D) If a triangle is equilateral, then it is equiangular.
39. An image of the unit circle is produced by the mapping rule $(x, y) \rightarrow (3x+2, 3y-4)$.
What is the diameter of the new circle?
- (A) $\sqrt{3}$
(B) 3
(C) 6
(D) 9
40. What are the coordinates of the centre of: $x^2 - 8x + y^2 = 9$?
- (A) (-8, 0)
(B) (-4, 0)
(C) (0, 4)
(D) (4, 0)

41. What is the exact value of $\sin^2 30^\circ + \cos 315^\circ$?

- (A) $\frac{1+\sqrt{2}}{6}$
- (B) $\frac{1-2\sqrt{2}}{4}$
- (C) $\frac{1+2\sqrt{2}}{4}$
- (D) $\frac{1+\sqrt{2}}{2}$

42. In the diagram, $AC = 24\text{m}$ and $OB = 5\text{m}$. What is the diameter of the circle in metres?

- (A) 13
- (B) 17
- (C) 26
- (D) 169

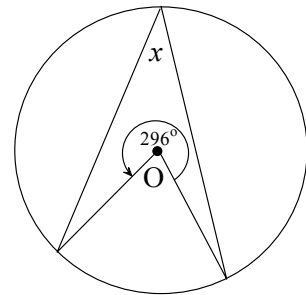


43. On a coordinate grid map, one ship is at A (15, 21), another ship is at B (3, 5), and a third ship is at C (-1.5, 15). A helicopter flies in a straight line from A to B and then from B to C. How many units does the helicopter fly in total?

- (A) 22.98
- (B) 30.97
- (C) 42.98
- (D) 53.95

44. On the circle shown having centre O, what is the measure of x in degrees?

- (A) 32
- (B) 64
- (C) 128
- (D) 296



45. What is the equation of the circle having centre (3, -1) and radius 4?

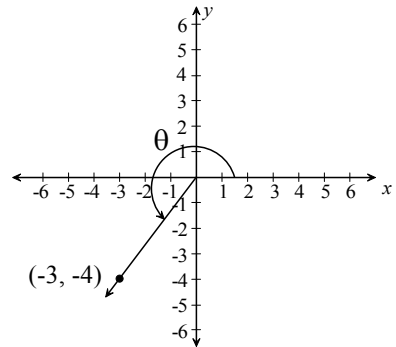
- (A) $\left[\frac{1}{4}(x-3)\right]^2 + \left[\frac{1}{4}(y+1)\right]^2 = 1$
- (B) $\left[\frac{1}{2}(x-3)\right]^2 + \left[\frac{1}{2}(y+1)\right]^2 = 1$
- (C) $\left[\frac{1}{4}(x+3)\right]^2 + \left[\frac{1}{4}(y-1)\right]^2 = 1$
- (D) $\left[\frac{1}{2}(x+3)\right]^2 + \left[\frac{1}{2}(y-1)\right]^2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

46. A circle with centre O has a diameter \overline{AB} . Given O(4, 8) and A(-3,6), what are the coordinates of B?

- (A) (11, 10)
- (B) (10, 11)
- (C) (5, 10)
- (D) (11, 22)

47. Using the diagram, what is the sine of θ ?

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

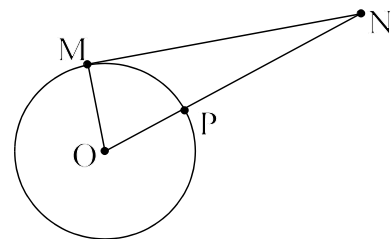


48. If the point (3, -2) lies on the circle defined by $x^2 + y^2 + 3x - my + 4 = 0$, what is the value of 'm'?

- (A) -13
- (B) -4
- (C) 4
- (D) 13

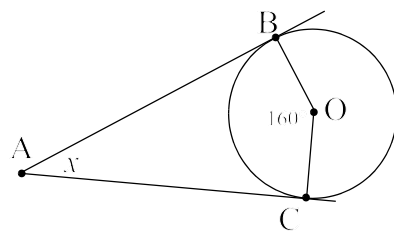
49. The circle shown has centre O, and has \overline{MN} tangent to the circle at point M. If $MN = 15$ and $OM = 8$, what is the measure of NP?

- (A) 9
- (B) 15
- (C) 17
- (D) 25



50. In the diagram, AB and AC are tangents to circle centre O. If $\angle BOC = 160^\circ$, what is the measure of x in degrees?

- (A) 10
- (B) 20
- (C) 80
- (D) 90



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: $3x^2 + 2x = 3$.

4%

52. A farmer is making a rectangular pen for chickens. One side of a barn will be used as a side of the pen and the farmer has 20m of fencing in total. Set up a quadratic function and use it to find the length and width of the pen that will give the pen maximum area.

Value

4%

53. A golf ball is hit from the top of a tower that is 24m high. The ball follows a parabolic path defined by the function $y = -5x^2 + 14x + 24$, where x represents the time in seconds since the ball was hit, and y represents the height of the ball above the ground in metres. Algebraically determine how long the ball is in the air.

4%

54. A batter hits a baseball into the air. The ball follows a path described by the equation $h(x) = -4.0x^2 + 36.2x + 3.0$ where h is the height of the ball above the ground in meters and x is the time in seconds since the ball was hit. Algebraically find the approximate instantaneous rate of change of height of the ball at 5.5 seconds.

Value

3% 55. Solve for x : $(\sqrt{3})^{4x} = 27^{x+3}$

4% 56. Solve for x : $\log_3 x + \log_3(x - 2) = 1$

4% 57. Suppose the cost of a ticket to an NHL hockey game increases by 7% yearly. If the cost of a ticket now is \$40, how long will it take to increase to \$60?

Value

4%

58. The temperature in a house at the time of a power failure was 22°C . The outside temperature was 0°C . If the temperature inside the house decreases at a rate of 13% every 2 hours, create a function to model the situation and use it to determine the temperature in the house after five hours.

3%

59. A circle has a diameter with endpoints $(-7, 4)$ and $(1, -2)$. Find the equation of the circle in standard form.

4%

60. Prove that the line $x - 4y + 30 = 0$ passes through the centre of $x^2 + y^2 + 12x - 12y + 27 = 0$.

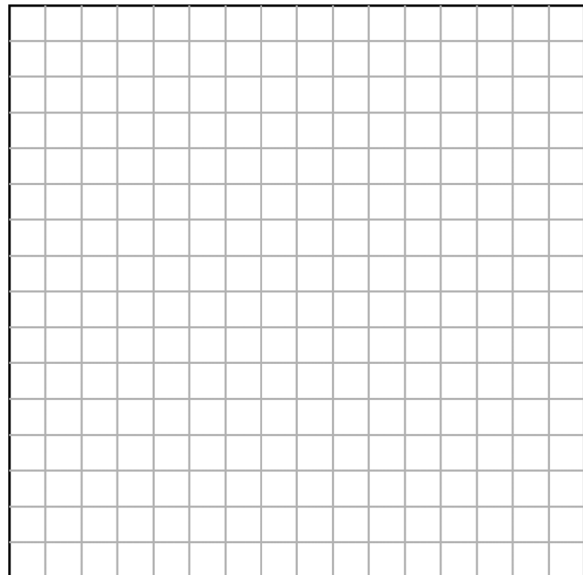
Value

4%

61. Determine the centre and lengths of the two axes of the ellipse
 $16x^2 + 9y^2 - 32x + 36y - 92 = 0$.

4%

62. Pat is building a garage. The four corners of the garage are located at A(4,8), B(- 6, 6), C(- 4, -4), and D(6, - 2). Prove quadrilateral ABCD is a square.



Value

4%

63. A circle with centre O, and the square OCDE, share some of the same area as shown. If $\angle OAB = 45^\circ$, $OB = 20\text{m}$, and $DE = 50\text{m}$, find the area of the shaded region.

