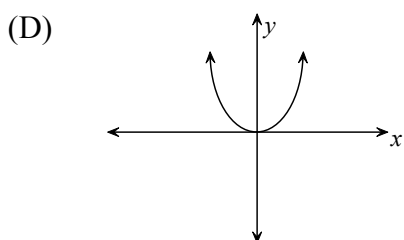
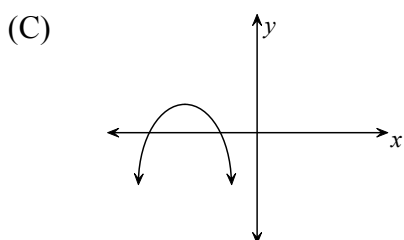
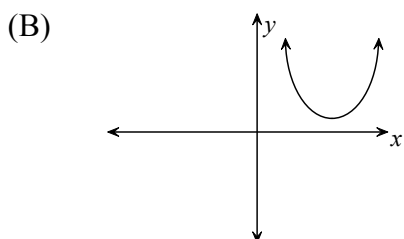
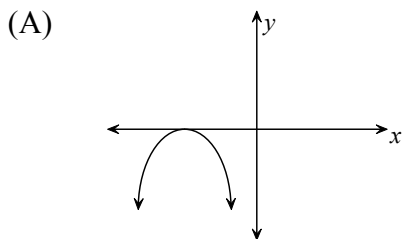


PART I
Total Value: 50%

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 one point.

1. A quadratic equation $g(x) = 0$, has a negative discriminant. Which is the graph of $g(x)$?



2. What type of function best models the sequence of dots shown below?

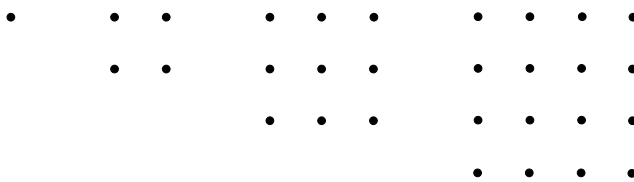
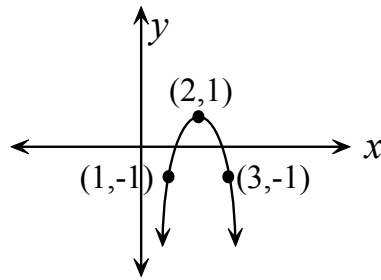


Figure 1 Figure 2 Figure 3 Figure 4

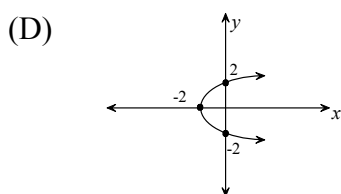
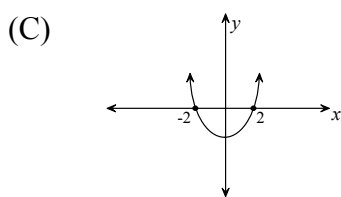
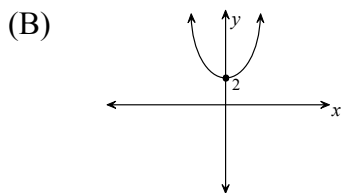
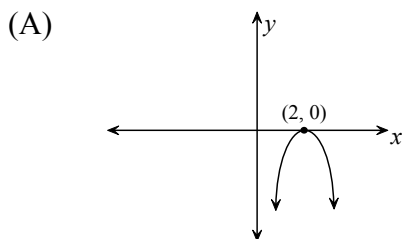
- (A) cubic
(B) exponential
(C) linear
(D) quadratic
3. What is the range of $y = (x - 2)^2 + 3$?

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

4. The graph of $y = x^2$ has been transformed as shown so that its new vertex is $(3,1)$. What is the vertical stretch factor?



- (A) $\frac{1}{2}$
 (B) 1
 (C) 2
 (D) 3
5. Which quadratic function has the widest graph?
- (A) $-2(y+3) = (x-4)^2$
 (B) $\frac{1}{2}(y+3) = (x-4)^2$
 (C) $2(y+3) = (x-4)^2$
 (D) $5(y+3) = (x-4)^2$
6. A quadratic equation $f(x) = 0$ has two equal real roots. Which is the graph of $f(x)$?



7. What is the simplest form of $\frac{-5 \pm \sqrt{-75}}{5}$?

- (A) $\pm 5i\sqrt{3}$
 (B) $-1 \pm 5i\sqrt{3}$
 (C) $-1 \pm i\sqrt{3}$
 (D) $-1 \pm i\sqrt{75}$

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

x	-1	0	1	2	3
y	37	26	17	10	5

- (A) cubic
 (B) exponential
 (C) linear
 (D) quadratic
9. The graph of $y = x^2$ has been transformed using the mapping rule $(x, y) \rightarrow (x-1, -2y+3)$. What is the new function?

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

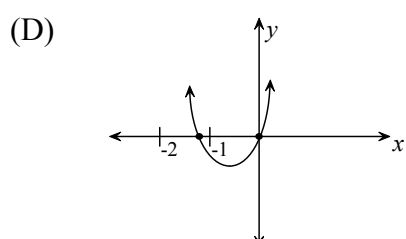
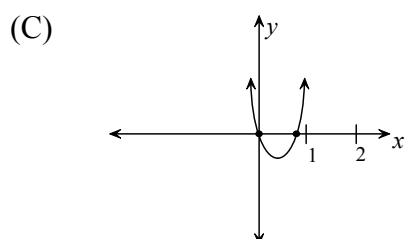
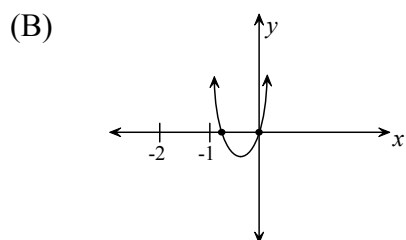
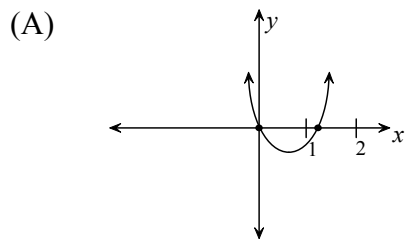
10. What is the general form of the function $y = (x-3)^2 + 11$?

- (A) $y-11 = (x-3)^2$
 (B) $y = x^2 + 20$
 (C) $y = x^2 - 6x + 2$
 (D) $y = x^2 - 6x + 20$

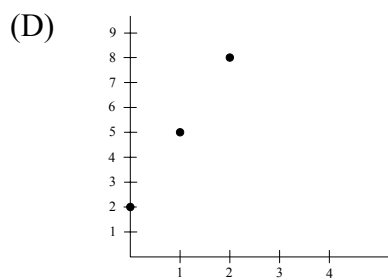
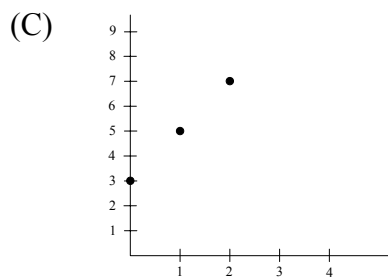
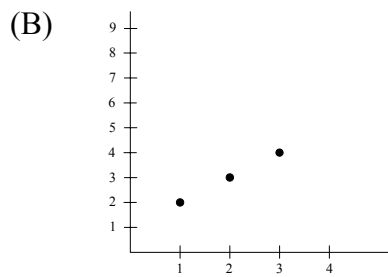
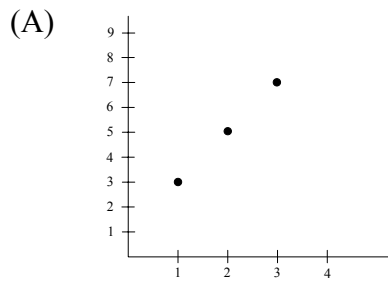
11. What are the roots of $x^2 - 6x = 16$?

- (A) $\{0, 6\}$
 (B) $\{-2, 8\}$
 (C) $\{2, -8\}$
 (D) $\{3 \pm i\sqrt{17}\}$

12. Which graph best represents the quadratic function $y = ax(4x+3), a > 0$?



13. The common difference between terms in a linear sequence, t_n , is 2. If $t_1 = 3$, which best illustrates the graph of t_n ?



14. Which describes the sequence $\{1, -1, -3, -5, -7, \dots\}$?

- (A) $t_n = -2n - 3$
 (B) $t_n = -2n + 1$
 (C) $t_n = -2n + 3$
 (D) $t_n = -2n - 1$

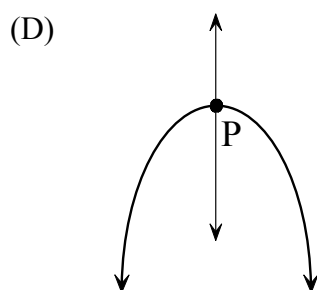
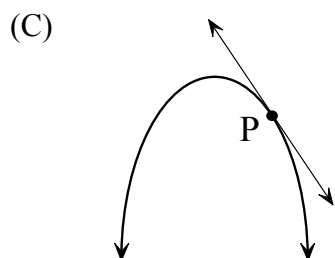
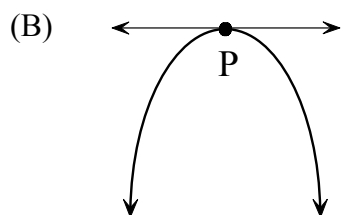
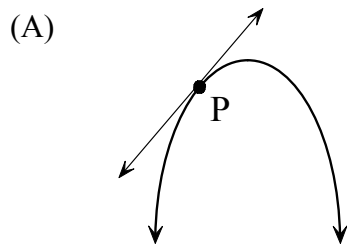
15. What value of k makes the polynomial $x^2 + kx + 36$ a perfect square?

- (A) 3
 (B) $3\sqrt{2}$
 (C) 6
 (D) 12

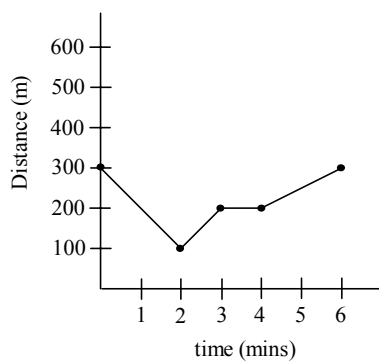
16. What is the vertex of $y = x^2 + 4x + 3$?

- (A) $(-4, -1)$
 (B) $(-2, -1)$
 (C) $(-2, 1)$
 (D) $(-2, 7)$

17. Which illustrates a positive instantaneous rate of change at P?

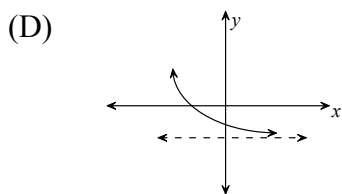
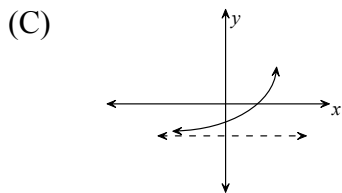
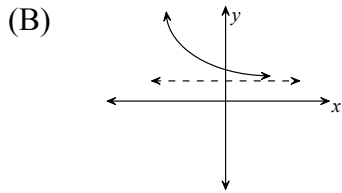
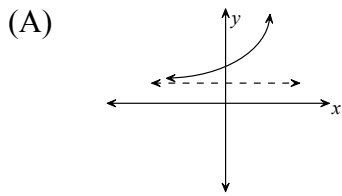


18. This distance-time graph shows the distance of a tour boat from an iceberg over a six-minute period. What is the average rate of change of distance between the tour boat and the iceberg from 3 to 6 minutes?



- (A) $\frac{3}{100}$
- (B) 25
- (C) $\frac{100}{3}$
- (D) 50

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



20. What is the common ratio between successive terms of the sequence generated by $t_n = 3(2)^{x+4} + 1$?

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

21. Which sequence represents an exponential function?

- (A) $\{1, 2, 3, 5, 8, \dots\}$
- (B) $\{1, 2, 4, 8, 16, \dots\}$
- (C) $\{1, 4, 7, 10, 13, \dots\}$
- (D) $\{1, 4, 9, 16, 25, \dots\}$

22. What is the domain of $y = \log_3 x$?

- (A) $\{x \mid x > 0, x \in \mathbf{R}\}$
- (B) $\{x \mid x > 3, x \in \mathbf{R}\}$
- (C) $\{y \mid y > 0, y \in \mathbf{R}\}$
- (D) $\{y \mid y > 3, y \in \mathbf{R}\}$

23. What is the inverse of the function $y = \log_5 x$?

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

24. Solve for x : $\log(x - 5) = \log 8$

- (A) -3
- (B) $-\frac{8}{5}$
- (C) 3
- (D) 13

25. Which function produces a growth curve?

- (A) $y = 4(0.8)^x$
- (B) $y = 2(-3)^x$
- (C) $y = \left(\frac{2}{5}\right)^x$
- (D) $y = \left(\frac{5}{2}\right)^x$

26. What is the equation of the horizontal asymptote of the graph of the function $y = -4(1.2)^x + 2.5$?

- (A) $y = -4$
- (B) $y = -2.5$
- (C) $y = 1.2$
- (D) $y = 2.5$

27. Solve for x : $3^{x+3} = 3^{4x-10}$

- (A) $-\frac{7}{3}$
- (B) $-\frac{7}{5}$
- (C) $\frac{13}{5}$
- (D) $\frac{13}{3}$

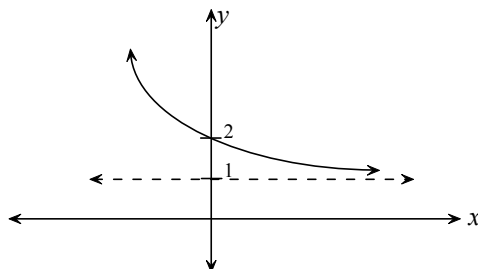
28. Which is the y -intercept of $y = 3(1.45)^x$?

- (A) $(0, 0)$
- (B) $(0, 1)$
- (C) $(0, 1.45)$
- (D) $(0, 3)$

29. What is $2 \log A + \log B - 5 \log C$ expressed as a single logarithm?

- (A) $\log(A^2 + B - C^5)$
- (B) $\log\left(\frac{A^2B}{C^5}\right)$
- (C) $\log(2A + B - 5C)$
- (D) $\log\left(\frac{2AB}{5C}\right)$

30. Which statement best describes this graph?



- (A) decay curve with vertical translation of 2 units up
- (B) decay curve with vertical translation of 1 unit up
- (C) growth curve with vertical translation of 2 units up
- (D) growth curve with vertical translation of 1 unit up

31. Which function describes this data?

x	-5	0	5	10	15
y	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{3}{2}$	$\frac{9}{2}$	$\frac{27}{2}$

- (A) $y = \frac{1}{6}(3)^{\frac{x}{5}}$
- (B) $y = \frac{1}{2}(3)^{x+5}$
- (C) $y = \frac{1}{2}(3)^{\frac{x}{5}}$
- (D) $y = \frac{1}{2}(3)^{5x}$

32. Solve for x : $2^{3x+5} = 16$

- (A) $-\frac{1}{3}$
- (B) 1
- (C) 3
- (D) $\frac{13}{3}$

33. Solve for x : $\log x + \log 3 = \log 15$

- (A) $\frac{1}{5}$
- (B) 5
- (C) 12
- (D) 18

34. Given $4^x = 9$, which best approximates x ?

- (A) 0.35
- (B) 1.17
- (C) 1.58
- (D) 2.25

35. Evaluate: $\left[16^{\frac{1}{2}} + \left(\frac{2}{3}\right)^0\right]^{-2}$

- (A) $\frac{1}{81}$
- (B) $\frac{1}{25}$
- (C) $\frac{17}{16}$
- (D) $\frac{25}{4}$

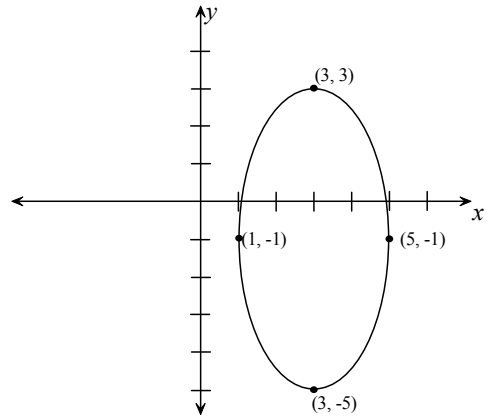
36. What is the simplest form of $\frac{8a^3}{(2a^3)^{-2}}$?

- (A) -2
- (B) $\frac{4}{a^3}$
- (C) $4a^9$
- (D) $32a^9$

37. If the point $(1, 0)$ on the unit circle is rotated 210° , what are the coordinates of the new point?
- (A) $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
 (B) $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
 (C) $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
 (D) $\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
38. Which statement has a converse that must also be true?
- (A) If a quadrilateral is a square, then it has four congruent sides.
 (B) If a quadrilateral is a square, then it is a rectangle.
 (C) If a triangle is equilateral, then it has three congruent sides.
 (D) If two triangles are congruent, then corresponding angles are congruent.
39. Which mapping rule transforms the unit circle to a circle having centre $(1, -5)$ and radius 4?
- (A) $(x, y) \rightarrow \left(\frac{1}{4}x - 1, \frac{1}{4}y + 5\right)$
 (B) $(x, y) \rightarrow \left(\frac{1}{4}x + 1, \frac{1}{4}y - 5\right)$
 (C) $(x, y) \rightarrow (4x - 1, 4y + 5)$
 (D) $(x, y) \rightarrow (4x + 1, 4y - 5)$
40. Which represents the standard form of the ellipse given by $\left[\frac{1}{3}(x-3)\right]^2 + \left[\frac{1}{2}(y+5)\right]^2 = 1$?
- (A) $4(x-3)^2 + 9(y+5)^2 = 1$
 (B) $4(x-3)^2 + 9(y+5)^2 = 36$
 (C) $9(x-3)^2 + 4(y+5)^2 = 1$
 (D) $9(x-3)^2 + 4(y+5)^2 = 36$
41. If a circle has a diameter with endpoints $(-2, 7)$ and $(10, 13)$, what is the length of the radius?
- (A) $\frac{3\sqrt{5}}{2}$
 (B) $3\sqrt{5}$
 (C) $6\sqrt{5}$
 (D) $2\sqrt{29}$
42. What is the exact value of $\cos 330^\circ - \sin^2 45^\circ$?
- (A) $\frac{\sqrt{3}-1}{2}$
 (B) $\frac{\sqrt{3}-2}{2}$
 (C) $\frac{\sqrt{3}-2}{4}$
 (D) $\frac{2\sqrt{3}-3}{4}$

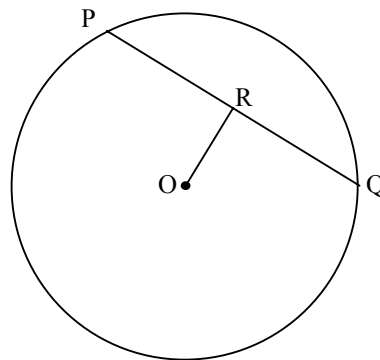
43. What is the equation of this ellipse?

- (A) $\left[\frac{1}{4}(x-3)\right]^2 + \left[\frac{1}{16}(y+1)\right]^2 = 1$
 (B) $\left[\frac{1}{4}(x+3)\right]^2 + \left[\frac{1}{16}(y-1)\right]^2 = 1$
 (C) $\left[\frac{1}{2}(x-3)\right]^2 + \left[\frac{1}{4}(y+1)\right]^2 = 1$
 (D) $\left[\frac{1}{2}(x+3)\right]^2 + \left[\frac{1}{4}(y-1)\right]^2 = 1$



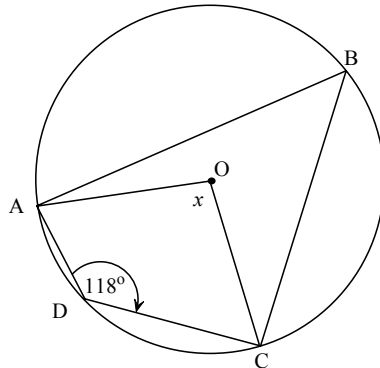
44. O is the centre of this circle and R is the midpoint of \overline{PQ} . If the diameter of the circle is 26 cm, and $\overline{OR} = 5$ cm, what is the length of the chord \overline{PQ} in cm?

- (A) 10
 (B) 12
 (C) 13
 (D) 24



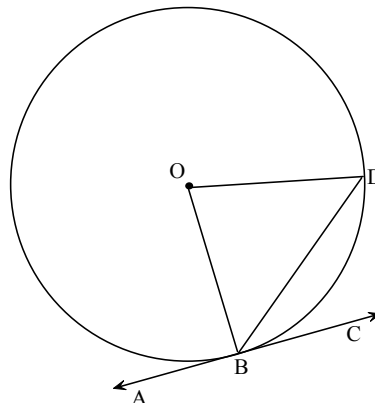
45. O is the centre of this circle. What is the measure of $\angle x$ in degrees?

- (A) 118
 (B) 124
 (C) 144
 (D) 152



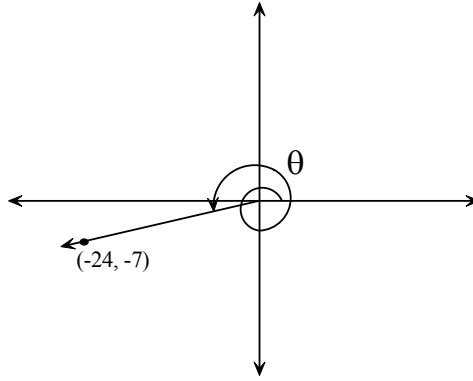
46. O is the centre of this circle and \overline{AC} is tangent to the circle at B. If $\angle DBC = 37^\circ$, what is the measure of $\angle DOB$ in degrees?

- (A) 18.5
 (B) 37
 (C) 53
 (D) 74



47. If $(-24, -7)$ is on the terminal arm of θ , what is $\sin \theta$?

- (A) $-\frac{24}{25}$
- (B) $-\frac{7}{25}$
- (C) $\frac{7}{25}$
- (D) $\frac{7}{24}$

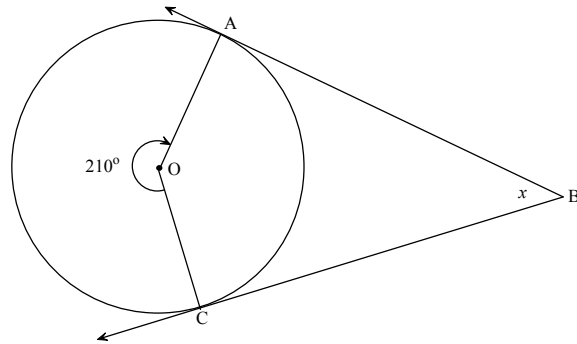


48. If the circle with centre $(0, m)$ has equation $x^2 + y^2 + 6y + 5 = 0$, what is the value of m ?

- (A) -5
- (B) -3
- (C) -1
- (D) 3

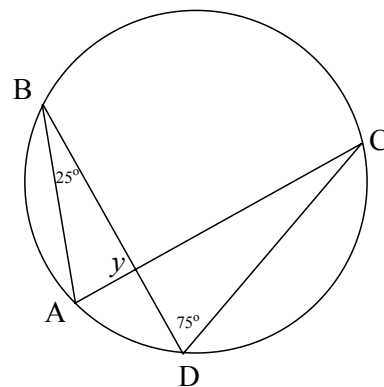
49. \overline{BA} and \overline{BC} are tangents to this circle having centre O . What is the measure of $\angle x$ in degrees?

- (A) 15
- (B) 30
- (C) 60
- (D) 75



50. Given the circle shown, what is the measure of $\angle y$ in degrees?

- (A) 70
- (B) 80
- (C) 90
- (D) 100



PART II
Total Value: 50%

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

Value

- 4 51. A toy rocket is launched from the top of a 30m high building so that its height, h , in metres above the ground t seconds later is given by $h(t) = 30 + 64t - 16t^2$. Algebraically determine the maximum height attained by the rocket.

- 4 52. A rectangular garden has a perimeter of 140m and an area of 1200m^2 . Set up a quadratic equation and solve it algebraically to find the dimensions of the garden.

Value

4 55. Solve for x : $\log_3 x + \log_3(x-8) = 2$

3 56. Solve for x : $\sqrt[3]{125^x} = \frac{5}{25^x}$

4 57. What annual interest rate (compounded annually) is necessary for \$8 500 to grow to \$9 000 in 3 years?

Value

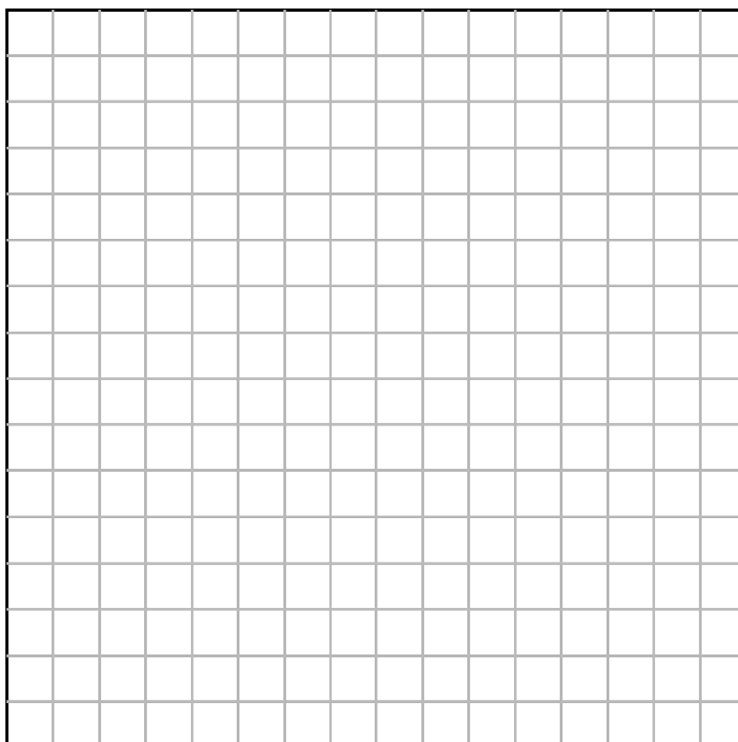
4 58. The chemical strontium has a half-life of 25 years. If 100 g were present initially, how many grams will remain in 18 months?

4 59. Write $9x^2 + 16y^2 - 18x + 64y - 71 = 0$ in transformational form.

3 60. A circle has centre $(-1, 3)$ and contains the point $(5, 7)$. What is its equation in standard form?

Value

- 4 61. A quadrilateral has coordinates $M(2, -6)$, $A(2, 4)$, $T(-4, 4)$ and $H(-4, -6)$. Sketch the quadrilateral and prove that the diagonals are congruent.



- 4 62. Determine the centre and length of a diameter of the circle given by:
 $4x^2 + 4y^2 - 8x + 24y - 24 = 0$.

Value

- 4 63. O is the centre of this circle having radius 8cm and $\overline{AC} = 7$ cm. In $\triangle AOB$, $AO = BO$, and $\angle AOB = 60^\circ$. Determine the area of the shaded region.

