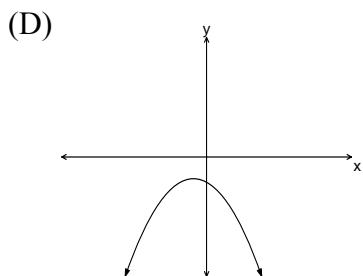
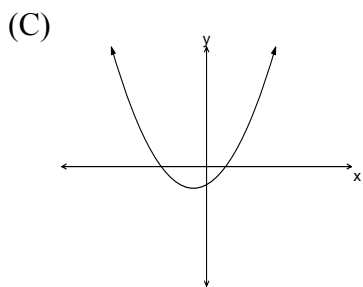
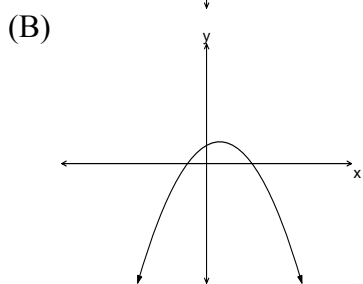
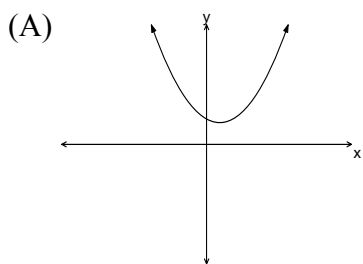


**PART I**  
**Total Value: 50%**

Answer all items. Shade the letter of the correct answer on the computer scorable answer sheet.

1. Which graph represents  $-3(y+2) = (x+1)^2$ ?



2. What is  $t_n$  for the sequence  $\{11, 7, 3, -1, -5, \dots\}$ ?

- (A)  $t_n = -4n + 7$
- (B)  $t_n = -4n + 15$
- (C)  $t_n = 4n + 7$
- (D)  $t_n = 4n + 15$

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

- (A)  $\{y \mid y \leq -5, y \in R\}$
- (B)  $\{y \mid y \geq -5, y \in R\}$
- (C)  $\{y \mid y \leq 5, y \in R\}$
- (D)  $\{y \mid y \geq 5, y \in R\}$

4. A quadratic equation  $f(x) = 0$  has a discriminant greater than 0. How many times does the graph of  $f(x)$  cross the  $x$ -axis?

- (A) 0
- (B) 1
- (C) 2
- (D) 3

5. Which mapping rule will transform  $y = x^2$  into the equation  $2(y - 4) = (x + 2)^2$ ?

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

6. Which represents a quadratic relationship?

(A) 

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

(B) 

$x$	1	2	3	4	5
$y$	3	6	9	12	15

(C) 

$x$	1	2	3	4	5
$y$	6	17	32	51	74

(D) 

$x$	1	2	3	4	5
$y$	5	12	31	68	129

7. What is the standard form of  $\frac{1}{2}(y + 25) = (x - 5)^2$ ?

- (A)  $y = -2(x - 5)^2 - 25$
- (B)  $y = -\frac{1}{2}(x - 5)^2 - 25$
- (C)  $y = \frac{1}{2}(x - 5)^2 - 25$
- (D)  $y = 2(x - 5)^2 - 25$

8. What is the discriminant of the equation  $9x^2 - 6x + 1 = 0$ ?

- (A) -72
- (B) 0
- (C)  $\frac{1}{3}$
- (D) 72

9. What is the common difference between successive terms in the sequence generated by  $t_n = -\frac{1}{2}n + 5$ ?
- (A)  $-5$   
(B)  $-\frac{1}{2}$   
(C)  $\frac{1}{2}$   
(D)  $5$
10. What is the vertex of the graph of a quadratic function that has  $x$ -intercepts of  $(-6, 0)$  and  $(2, 0)$  and a minimum value of  $-7$ ?
- (A)  $(-7, -4)$   
(B)  $(-7, -2)$   
(C)  $(-4, -7)$   
(D)  $(-2, -7)$
11. Solve:  $x^2 - x = 6$ .
- (A)  $\{-2\}$   
(B)  $\{3\}$   
(C)  $\{-2, 3\}$   
(D)  $\{2, -3\}$
12. Which represents a graph that opens downward and has a vertical stretch factor of  $\frac{1}{3}$ ?
- (A)  $-3(y - 2) = x^2$   
(B)  $-\frac{1}{3}(y - 2) = x^2$   
(C)  $\frac{1}{3}(y - 2) = x^2$   
(D)  $3(y - 2) = x^2$
13. The path of a ball is given by  $h = -5t^2 + 20t + 6$ , where  $h$  represents the height, in metres, and  $t$  represents the time, in seconds. At what time does the ball reach its maximum height?
- (A)  $2$   
(B)  $4$   
(C)  $6$   
(D)  $26$
14. Which transformations of  $y = x^2$  will produce the equation  $\frac{1}{2}(y + 1) = (x - 3)^2$ ?
- (A) vertical translation  $-1$ , horizontal translation  $3$ , vertical stretch  $\frac{1}{2}$   
(B) vertical translation  $-1$ , horizontal translation  $3$ , vertical stretch  $2$   
(C) vertical translation  $1$ , horizontal translation  $-3$ , vertical stretch  $\frac{1}{2}$   
(D) vertical translation  $1$ , horizontal translation  $-3$ , vertical stretch  $2$

15. Two numbers have a difference of 10 and their product is a minimum. Which quadratic function best models this situation?

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

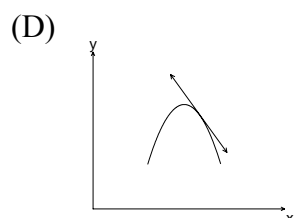
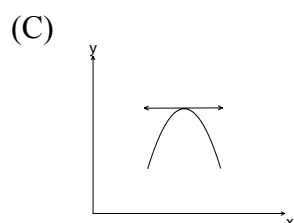
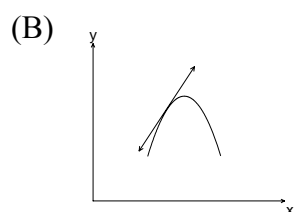
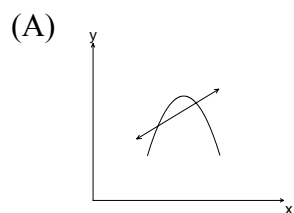
16. If the graph of  $y = x^2$  is transformed using  $(x, y) \rightarrow (x-3, -y+4)$ , what is the vertex?

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

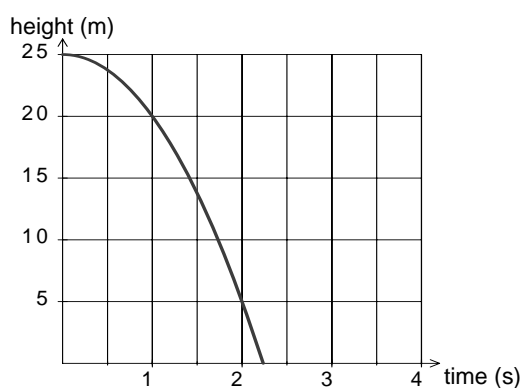
17. What are the zeros of the function  $f(x) = 2x^2 + 10$ ?

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

18. Which line illustrates a positive instantaneous rate of change?



19. The path of a ball thrown from a height of 25 m is shown in the graph below. What is the average rate of change, in m/s, between 0 and 2 seconds?



- (A)  $-10$   
 (B)  $-\frac{1}{10}$   
 (C)  $\frac{1}{10}$   
 (D)  $10$
20. Which represents a geometric sequence?
- (A) 

$x$	0	3	6	9	12
$y$	200	250	300	350	400
- (B) 

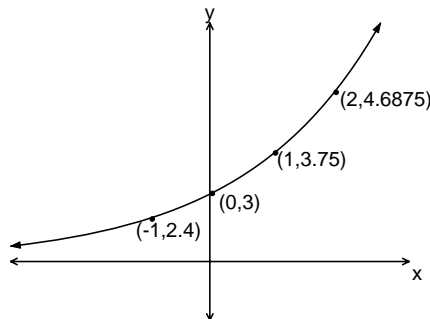
$x$	0	2	4	6	8
$y$	200	160	128	102.4	81.92
- (C) 

$x$	0	1	2	3	4
$y$	0	7	16	27	40
- (D) 

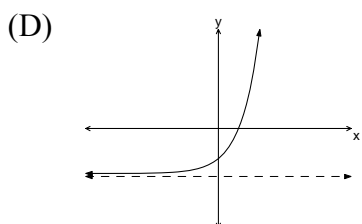
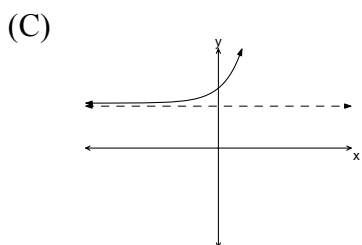
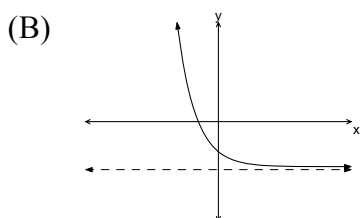
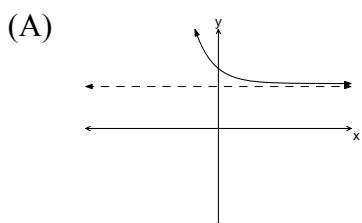
$x$	0	4	8	12	16
$y$	5	117	965	3317	7941
21. What is the  $y$ -intercept of  $f(x) = 8\left(\frac{1}{2}\right)^x - 3$ ?
- (A)  $(0, -3)$   
 (B)  $(0, 5)$   
 (C)  $(0, 8)$   
 (D)  $(0, 11)$
22. What is the range of  $f(x) = 3\left(\frac{1}{2}\right)^x - 5$ ?
- (A)  $\{y \mid y < -5, y \in R\}$   
 (B)  $\{y \mid y > -5, y \in R\}$   
 (C)  $\{y \mid y \leq -5, y \in R\}$   
 (D)  $\{y \mid y \geq -5, y \in R\}$
23. What is the equation of the asymptote of  $y = 2(3)^x + 4$ ?
- (A)  $y = 2$   
 (B)  $y = 3$   
 (C)  $y = 4$   
 (D)  $y = 6$

24. What is the common ratio for the exponential function shown below?

- (A) 0.25
- (B) 0.60
- (C) 0.80
- (D) 1.25



25. Which graph represents  $y = \left(\frac{1}{3}\right)^x + c$ ,  $c > 0$ ?



26. Which function describes the data below?

$x$	-4	0	4	8	12
$y$	20	60	180	540	1620

- (A)  $f(x) = 20(3)^{\frac{x}{4}}$
- (B)  $f(x) = 20(3)^{\frac{4}{x}}$
- (C)  $f(x) = 60(3)^{\frac{x}{4}}$
- (D)  $f(x) = 60(3)^{\frac{4}{x}}$

27. Simplify:  $\frac{9^x \cdot 27}{3^x}$ .

- (A)  $3^{5x}$
- (B)  $3^{7x}$
- (C)  $3^{x+3}$
- (D)  $3^{3x+3}$

28. Simplify:  $\frac{4x^{\frac{2}{3}}}{2x^{\frac{2}{3}}y^{-3}}$ .

- (A)  $-\frac{2}{y^3}$
- (B)  $-\frac{8}{y^3}$
- (C)  $2y^3$
- (D)  $8y^3$

29. Solve:  $5^{4x} = \sqrt{5}$ .

- (A)  $\frac{1}{8}$
- (B)  $\frac{1}{2}$
- (C) 2
- (D) 8

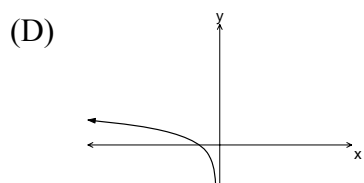
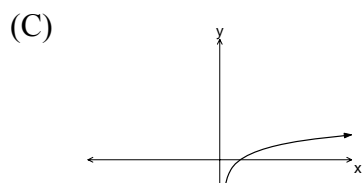
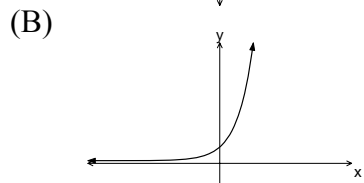
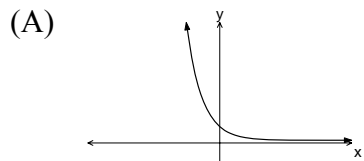
30. What is the logarithmic form of  $25^{-\frac{1}{2}} = \frac{1}{5}$ ?

- (A)  $\log_{-\frac{1}{2}} \frac{1}{5} = 25$
- (B)  $\log_{\frac{1}{5}} 25 = -\frac{1}{2}$
- (C)  $\log_{25} \left(-\frac{1}{2}\right) = \frac{1}{5}$
- (D)  $\log_{25} \left(\frac{1}{5}\right) = -\frac{1}{2}$

31. What is the inverse of  $y = 6^x$ ?

- (A)  $x = \log_y 6$
- (B)  $x = \log_6 y$
- (C)  $y = \log_x 6$
- (D)  $y = \log_6 x$

32. Which represents the inverse of  $y = \log_3 x$ ?



33. Solve:  $3 \log_4 2 = x$ .

- (A) 0.50
- (B) 0.67
- (C) 1.29
- (D) 1.50

34. Write as a single logarithm:  $2 \log A - \log B + 3 \log C$ .

- (A)  $\log(A^2 - B + C^3)$
- (B)  $\log \frac{A^2}{BC^3}$
- (C)  $\log \frac{2AB}{3C}$
- (D)  $\log \frac{A^2 C^3}{B}$

35. Solve:  $\log_4 x - \log_4 2 = \log_4 (x-1)$ .

- (A) -1
- (B) 0
- (C) 1
- (D) 2

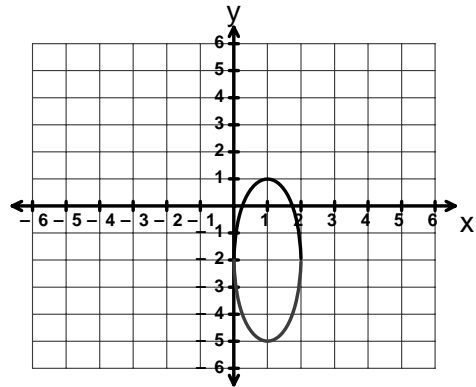
36. What is the value of  $x$  if  $3^x = 13$ ?

- (A)  $\log\left(\frac{3}{13}\right)$
- (B)  $\log\left(\frac{13}{3}\right)$
- (C)  $\frac{\log 3}{\log 13}$
- (D)  $\frac{\log 13}{\log 3}$

37. If two triangles are congruent, then their corresponding sides and corresponding angles are equal. What is the converse of this statement?

- (A) If corresponding sides and corresponding angles of a triangle are equal, then the triangles are congruent.
- (B) If corresponding sides and corresponding angles of a triangle are not equal, then the triangles are congruent.
- (C) If two triangles are congruent, then their corresponding sides and corresponding angles are not equal.
- (D) If two triangles are not congruent, then their corresponding sides and corresponding angles are not equal.

38. Which equation models the graph below?



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

39. If  $[\frac{1}{4}(x-5)]^2 + [\frac{1}{4}(y-3)]^2 = 1$  is translated 4 units to the right and 3 units down, what is the new equation?

- (A)  $[\frac{1}{4}(x-9)]^2 + [\frac{1}{4}y]^2 = 1$
- (B)  $[\frac{1}{4}(x-9)]^2 + [\frac{1}{4}(y-6)]^2 = 1$
- (C)  $[\frac{1}{4}(x-1)]^2 + [\frac{1}{4}y]^2 = 1$
- (D)  $[\frac{1}{4}(x-1)]^2 + [\frac{1}{4}(y-6)]^2 = 1$

40. The midpoint of  $\overline{AB}$  is  $(-6, 4)$ . If endpoint A has coordinates  $(2, -3)$ , what are the coordinates of endpoint B?

- (A)  $(-14, 11)$
- (B)  $(-10, 5)$
- (C)  $(-8, 7)$
- (D)  $(-2, \frac{1}{2})$

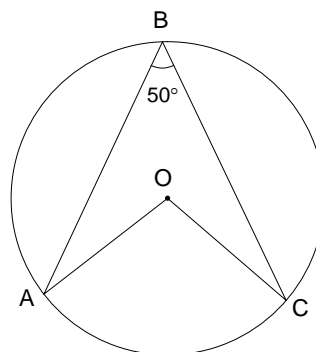
41. What is the transformational form of the equation for the image of the unit circle under the mapping rule  $(x, y) \rightarrow (7x, 7y - 2)$ ?

- (A)  $\left[\frac{1}{\sqrt{7}}x\right]^2 + \left[\frac{1}{\sqrt{7}}(y-2)\right]^2 = 1$
- (B)  $\left[\frac{1}{\sqrt{7}}x\right]^2 + \left[\frac{1}{\sqrt{7}}(y+2)\right]^2 = 1$
- (C)  $\left[\frac{1}{7}x\right]^2 + \left[\frac{1}{7}(y-2)\right]^2 = 1$
- (D)  $\left[\frac{1}{7}x\right]^2 + \left[\frac{1}{7}(y+2)\right]^2 = 1$

42. The point  $(1, 0)$  on the terminal arm of angle  $\theta$  is rotated  $-120^\circ$ . What is the exact value of the image point?

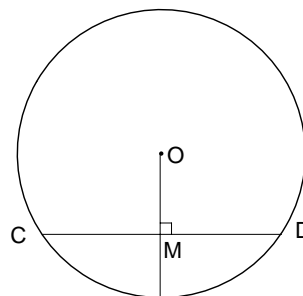
- (A)  $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
- (B)  $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
- (C)  $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
- (D)  $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

43. In the circle with centre O shown,  $\angle ABC = 50^\circ$  and the diameter is 10 cm. What is the length, in cm, of minor  $\widehat{AC}$ ?



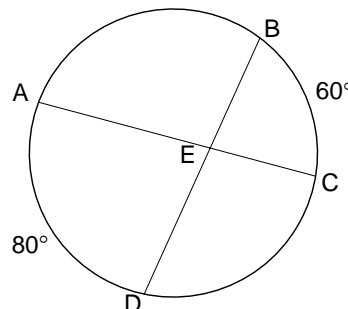
- (A) 4.36
- (B) 8.73
- (C) 17.45
- (D) 21.82

44. In the circle with centre O shown,  $\overline{CD} = 48$  units while  $\overline{OM} = 18$  units. What is the length of the diameter?



- (A) 30
- (B) 45
- (C) 60
- (D) 89

45. In the circle shown, minor  $\widehat{AD} = 80^\circ$  and minor  $\widehat{BC} = 60^\circ$ . What is the measure, in degrees, of  $\angle BEC$ ?



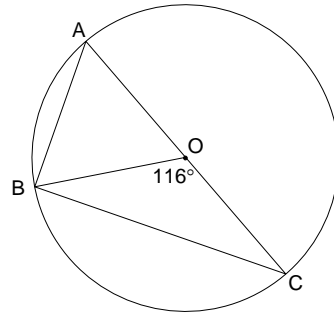
- (A) 60
- (B) 70
- (C) 80
- (D) 120

46. What is the centre of  $x^2 + y^2 + 2x - 4 = 0$ ?

- (A)  $(-2, 0)$
- (B)  $(-1, 0)$
- (C)  $(1, 0)$
- (D)  $(2, 0)$

47. In the circle with centre O shown,  $\angle BOC = 116^\circ$ . What is the measure, in degrees, of  $\angle ABO$ ?

- (A) 32
- (B) 52
- (C) 58
- (D) 64

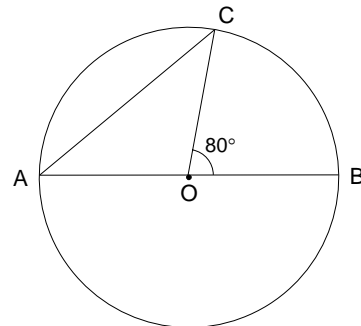


48. The distance between A(3,1) and B(7, y) is 5 units. What is a possible value for y?

- (A) 2
- (B) 4
- (C) 6
- (D) 10

49. In the circle with centre O shown,  $\angle COB = 80^\circ$ . What is the measure, in degrees, of  $\angle CAB$ ?

- (A) 20
- (B) 40
- (C) 50
- (D) 80



50. An ellipse has vertices at  $(1, 4)$  and  $(1, -4)$ . If the ellipse passes through the point  $(4, 0)$  what is the length of the minor axis?

- (A) 3
- (B) 4
- (C) 6
- (D) 8

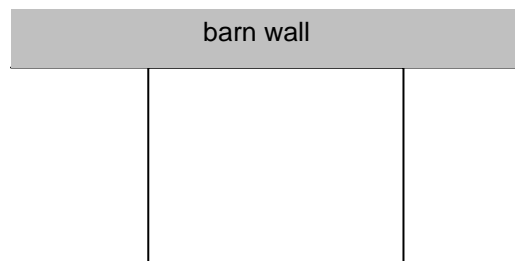
**PART II**  
**Total Value: 50%**

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

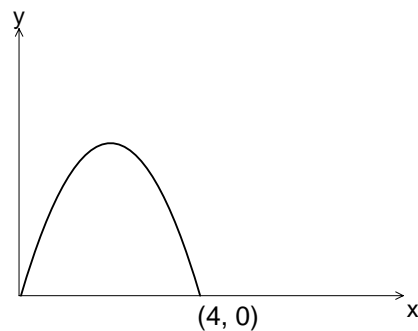
Value

4     51.     Algebraically determine the **exact** roots in simplest form for  $x = \frac{-13}{x-2}$ .

- 4     52.     A farmer is constructing a pig pen and is using his barn wall as one side of the pen. If he has 32 m of fencing and wants to use it all, write the quadratic function that models the area of the pig pen, and use it to determine the maximum area of the pen.

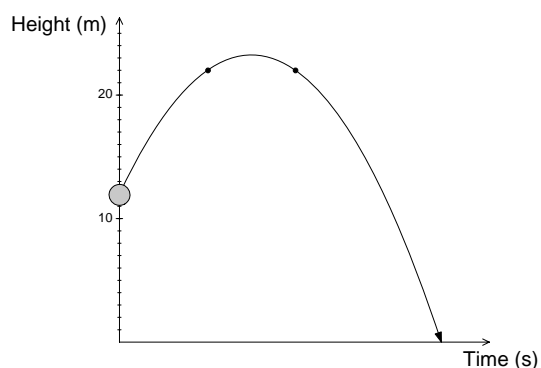


- 4     53.     A golf ball is hit from the ground and lands on the green after 4 seconds. If the golf ball reaches a maximum height of 20 m, algebraically determine the quadratic function representing its path, and use it to determine the approximate height of the ball at 3 seconds.



Value

- 4 54. A cannonball is shot into the air as shown below. The height of the ball above the ground, in metres,  $t$  seconds after being shot is approximated by  $h(t) = -5t^2 + 15t + 12$ . Algebraically determine the times when the ball is at a height of 22 m.



- 4 55. The motion of a ball thrown upward from the ground is described by  $h(t) = -4.9t^2 + 11t$ , where  $h$  is the height of the ball in metres and  $t$  is the time in seconds. Algebraically determine the approximate instantaneous rate of change in the height of the ball at 2 seconds, and describe how the height of the ball is changing at that instant.

- 4 56. Algebraically solve for  $x$ :  $32\left(\frac{1}{4}\right)^{x+2} = 8^{\frac{4}{3}}$ .

Value

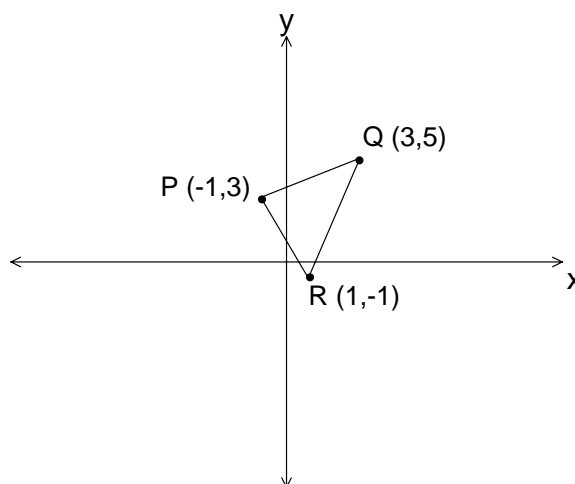
- 4      57.      Algebraically solve for  $x$ :  $\log_7 4 + \log_7 (x+3) = 2\log_7 x$ .
- 4      58.      A toxin is accidentally released into a pond, affecting the trout population. Initially there were 1500 trout in the pond, but after 5 months this number was reduced to 1050. After another 5 months, there were 735 trout. If this pattern continues, algebraically determine the exponential equation that models this situation, and use it to determine the trout population one year after the toxin was released.
- 4      59.      A student invests \$2 000 with a bank that promises to double the investment in 7 years. Write an exponential equation that models this situation and use it to determine when the investment will be worth \$10 000.

Value

- 3 60. Write  $4x^2 + y^2 - 8x - 12 = 0$  in transformational form, and state the coordinates of the centre and the length of the major axis.

- 3 61. Determine the equation of the circle, in general form, with centre  $(-3, 4)$  and passing through the point  $(3, 12)$ .

- 4 62. Using coordinate geometry, prove that  $\triangle PQR$  is both a right and an isosceles triangle.



Value

- 4 63. In the concentric circles with centre O shown, minor  $\widehat{AB} = 50^\circ$ . Determine the area of the shaded region.

