

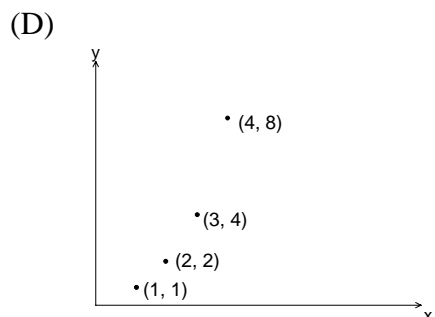
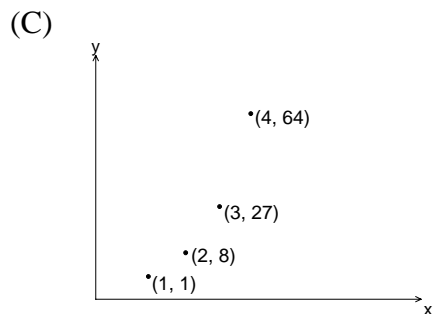
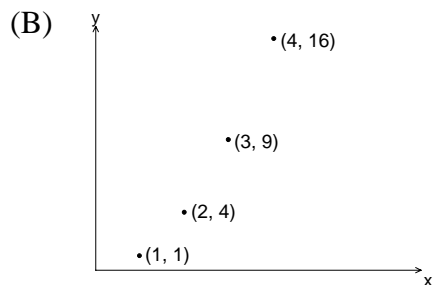
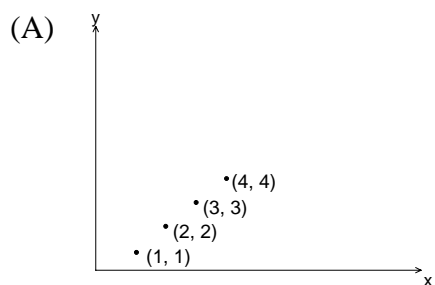
PART I
Total Value: 50%

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

1. What is the first level difference between successive terms in the sequence generated by $t_n = \frac{4}{3} - \frac{2}{5}n$?

- (A) $-\frac{4}{3}$
- (B) $-\frac{2}{5}$
- (C) $\frac{2}{5}$
- (D) $\frac{4}{3}$

2. Which represents a quadratic sequence?



3. What values of b will make $x^2 + bx + 19$ a perfect square trinomial?

- (A) $\pm \frac{\sqrt{19}}{2}$
- (B) $\pm \sqrt{19}$
- (C) $\pm 2\sqrt{19}$
- (D) $\pm \frac{19}{2}$

4. Which equation represents the image of $y = x^2$ under the mapping rule $(x, y) \rightarrow (x+1, -\frac{1}{3}y)$?

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

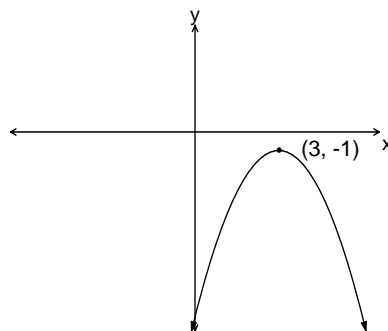
5. What is the product of the roots for $2x^2 + 5x - 3 = 0$?

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

6. Which quadratic equation has root $-2 + 3\sqrt{3}$?

- (A) $x^2 - 4x - 23 = 0$
- (B) $x^2 - 4x + 31 = 0$
- (C) $x^2 + 4x - 23 = 0$
- (D) $x^2 + 4x + 31 = 0$

7. What is the equation of the axis of symmetry for the graph below?



- (A) $x = -3$
- (B) $x = -1$
- (C) $x = 1$
- (D) $x = 3$

8. What are the zeros of the function $f(x) = 3x(x+2) + 2(x+2)$?

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

9. What is the range of the function $-\frac{1}{4}(y+8) = (x-3)^2$?
- (A) $\{y \mid y \leq -8, y \in R\}$
 (B) $\{y \mid y \geq -8, y \in R\}$
 (C) $\{y \mid y \leq 8, y \in R\}$
 (D) $\{y \mid y \geq 8, y \in R\}$
10. Which equation has roots -2 and $\frac{3}{4}$?
- (A) $4x^2 - 11x + 6 = 0$
 (B) $4x^2 - 5x - 6 = 0$
 (C) $4x^2 + 5x - 6 = 0$
 (D) $4x^2 + 11x + 6 = 0$
11. What is the general form of $-\frac{1}{2}(y+2) = (x-1)^2$?
- (A) $y = -2x^2 - 4x$
 (B) $y = -2x^2 + 4x$
 (C) $y = -2x^2 - 4x - 4$
 (D) $y = -2x^2 + 4x - 4$
12. What is the nature of the roots of $2x(x+2) - 3x = -5$?
- (A) equal and imaginary
 (B) equal and real
 (C) unequal and imaginary
 (D) unequal and real
13. The school cafeteria sells 120 bottles of juice at a cost of \$2. If for every 20 cent decrease in cost there is an increase in sales of 25 bottles, which equation describes the revenue?
- (A) $R = (120 - 25x)(2 + 0.20x)$
 (B) $R = (120 - 20x)(2 + 25x)$
 (C) $R = (120 + 20x)(2 - 25x)$
 (D) $R = (120 + 25x)(2 - 0.20x)$
14. What is the value of k if $x = 3$ is a root of $2x^2 - kx - 3 = 0$?
- (A) -5
 (B) -3
 (C) 3
 (D) 5
15. Solve: $(4 - 2x)^2 = 24$.
- (A) $\pm i\sqrt{2}$
 (B) $\pm\sqrt{2}$
 (C) $-2 \pm \sqrt{6}$
 (D) $2 \pm \sqrt{6}$

16. What is the value of k if the sum of the roots of $4x^2 - 3kx - 8 = 0$ is -12 ?

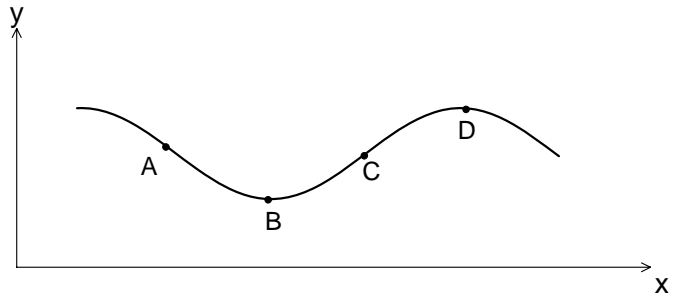
- (A) -32
- (B) -16
- (C) 16
- (D) 32

17. What is the y -intercept of $-\frac{1}{5}(y+1) = (x-2)^2$?

- (A) -21
- (B) -19
- (C) 19
- (D) 21

18. At which point would a tangent be drawn to best indicate a positive instantaneous rate of change?

- (A) A
- (B) B
- (C) C
- (D) D



19. An ice cube with side lengths of 8 cm is melting such that the length is decreasing at a rate of 3 mm/second. Which represents the volume of the cube at any given instant?

- (A) $V = 8 - 0.3t^3$
- (B) $V = (8 - 0.3t)^3$
- (C) $V = (8 - 3t)^3$
- (D) $V = 8 - 3t^3$

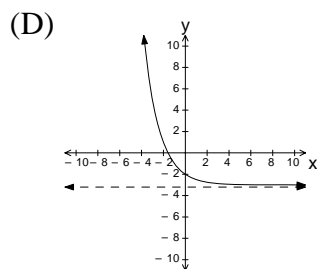
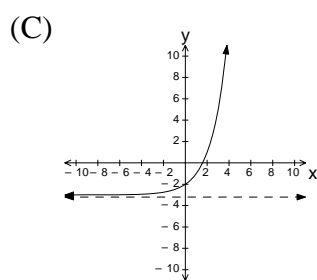
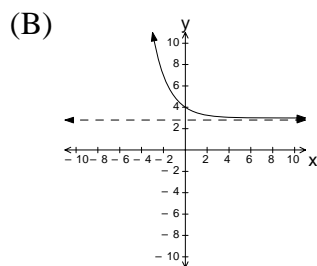
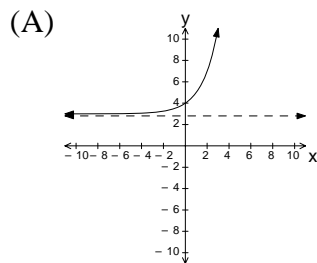
20. What is the y -intercept of $y = 2(3)^{x+1} - 5$?

- (A) $(0, -5)$
- (B) $(0, -3)$
- (C) $(0, 1)$
- (D) $(0, 2)$

21. When $y = 3^x$ is transformed by the mapping rule $(x, y) \rightarrow (4x + 8, \frac{1}{2}y - 2)$, what is the equation of the resulting image?

- (A) $2(y - 2) = 3^{\frac{1}{4}x - 8}$
- (B) $2(y - 2) = 3^{\frac{1}{4}x - 2}$
- (C) $2(y + 2) = 3^{\frac{1}{4}x - 8}$
- (D) $2(y + 2) = 3^{\frac{1}{4}x - 2}$

22. Which graph represents an exponential function of the form $y - 3 = b^{-x}$, where $0 < b < 1$?



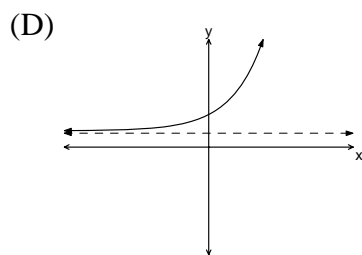
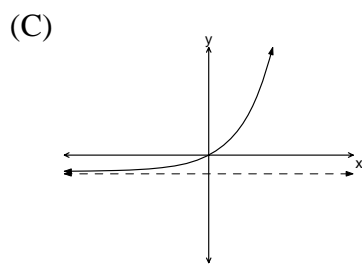
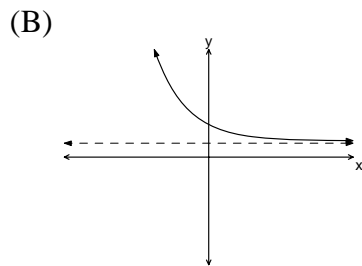
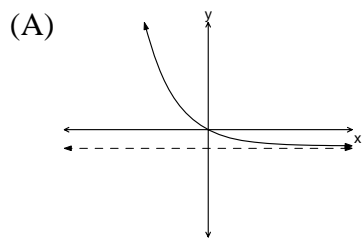
23. What is the range of the function given by $y = 2(3)^x - 5$?

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

24. If the function $y = \left(\frac{1}{2}\right)^x$ is transformed by the mapping rule $(x, y) \rightarrow \left(\frac{1}{4}x - 2, y + 5\right)$, what are the coordinates of the focal point of the image?

- (A) $\left(-\frac{7}{4}, 5\right)$
- (B) $(-2, 6)$
- (C) $(0, 1)$
- (D) $(2, -6)$

25. Which graph represents $y + 1 = \left(\frac{1}{2}\right)^x$?



26. Solve for x : $\log_4 x + 3\log_4 2 = 3$.

- (A) 2
- (B) 8
- (C) $\frac{3}{2}$
- (D) $\frac{32}{3}$

27. Which is equivalent to $4\left(\frac{1}{8}\right)^x$?

- (A) 2^{-6x}
- (B) 2^{-4x+2}
- (C) 2^{-3x+2}
- (D) 2^{-x}

28. Which is true if $f(x) = \log_3 x$?

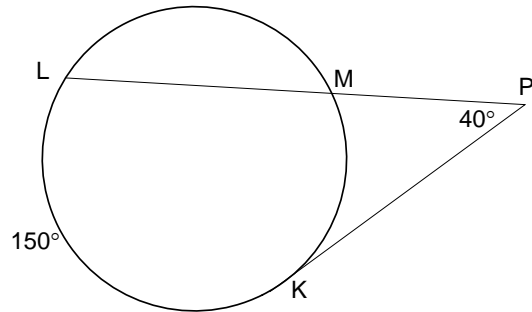
- (A) $f(x+y) = f(x)f(y)$
- (B) $f(x+y) = f(x) + f(y)$
- (C) $f(xy) = f(x) \cdot f(y)$
- (D) $f(xy) = f(x) + f(y)$

29. Solve: $5^{2x-3} = \left(\frac{1}{125}\right)^x$.
- (A) -3
(B) $-\frac{3}{5}$
(C) $\frac{3}{5}$
(D) 3
30. What is the inverse of $y = 3^x$?
- (A) $x = \log_y 3$
(B) $x = \log_3 y$
(C) $y = \log_x 3$
(D) $y = \log_3 x$
31. Solve: $\log_x 5 = \frac{1}{2}$.
- (A) $\frac{1}{10}$
(B) $\sqrt{5}$
(C) 10
(D) 25
32. Evaluate: $5^0 + \log_3 21$.
- (A) 1.36
(B) 1.85
(C) 2.64
(D) 3.77
33. What is the domain of $y = \log_5(x+3)$?
- (A) $\{x \mid x < -3, x \in R\}$
(B) $\{x \mid x \leq -3, x \in R\}$
(C) $\{x \mid x > -3, x \in R\}$
(D) $\{x \mid x \geq -3, x \in R\}$
34. Simplify: $(x^{-2} - y^{-1})^{-1}$.
- (A) $x^2 - y$
(B) $\frac{x^2 y}{y - x^2}$
(C) $\frac{1}{x^2 - y}$
(D) $\frac{y - x^2}{x^2 y}$
35. What is the simplified form of $\frac{(8^{n-2})(4^n)}{2^{n+1}}$?
- (A) 2^{4n-7}
(B) 2^{4n-5}
(C) 16^{n-3}
(D) 16^{n-1}

36. What is a possible value of x for $(x-2)^{\frac{2}{3}} = 16$?

- (A) 64
- (B) 66
- (C) 510
- (D) 514

37. In the circle shown with tangent \overline{PK} and secant \overline{PL} , $\angle P = 40^\circ$, and minor $\widehat{LK} = 150^\circ$. What is the value, in degrees, of minor \widehat{MK} ?



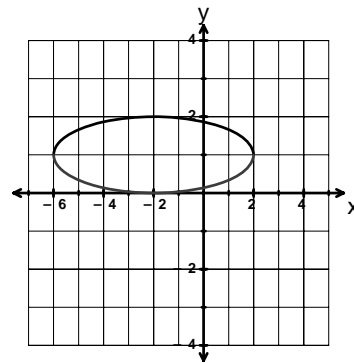
- (A) 35
- (B) 55
- (C) 70
- (D) 95

38. Given $P(a,b)$ and $Q(5a,7b)$, what is the slope of the line connecting $R(a,6b)$ to the midpoint of \overline{PQ} ?

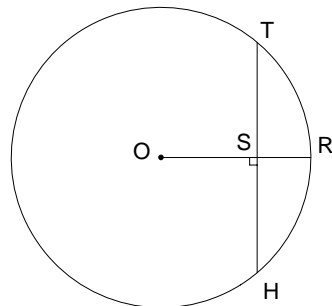
- (A) $-\frac{b}{a}$
- (B) $-\frac{a}{b}$
- (C) $\frac{b}{a}$
- (D) $\frac{a}{b}$

39. Which equation represents the graph shown?

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



40. In the circle with centre O shown, chord $\overline{TH} = 8$. If the radius of the circle is 5, what is the length of \overline{SR} ?



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

41. What is the centre of $6x^2 + 6y^2 - 12x = 0$?

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

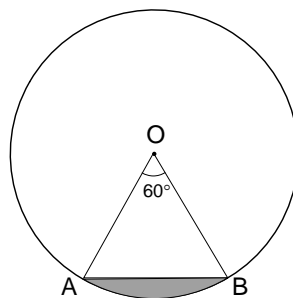
42. If a point $P(2,0)$ is rotated 150° clockwise on a circle of radius 2, what are the new coordinates of P ?

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

43. What is the length of the major axis of $\frac{1}{25}x^2 + \frac{1}{9}(y-3)^2 = 1$?

- (A) 6
- (B) 10
- (C) 18
- (D) 50

44. In the circle with centre O shown, what is the approximate perimeter of the shaded region, in cm, if the radius is 12 cm?

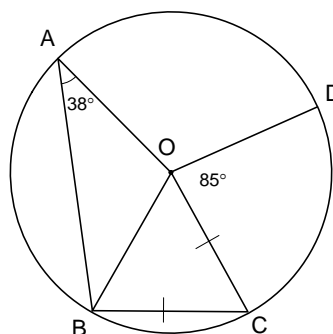


- (A) 12.0
- (B) 12.6
- (C) 24.6
- (D) 25.2

45. If two sides of a triangle are congruent, then the angles opposite the congruent sides are congruent. What is the converse of this statement?

- (A) If two angles of a triangle are congruent, then the sides opposite the congruent angles are congruent.
- (B) If two angles of a triangle are congruent, then the sides opposite the congruent angles are not congruent.
- (C) If two sides of a triangle are congruent, then the angles opposite these sides are not congruent.
- (D) If two sides of a triangle are not congruent, then the angles opposite these sides are not congruent.

46. In the circle with centre O shown, $\overline{OC} = \overline{BC}$. What is the measure, in degrees, of $\angle AOD$?



- (A) 95
- (B) 103
- (C) 111
- (D) 130

47. Which represents an ellipse?

- (A) $3x^2 + 3y^2 - 6y = 24$
- (B) $3x^2 + y^2 - 6y = 24$
- (C) $3x^2 + y = 24$
- (D) $3x^2 + 3y^2 - 6x - 6y = 24$

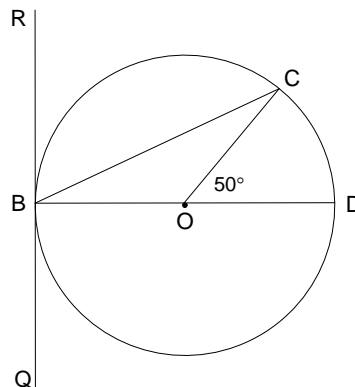
48. Which mapping rule will transform $x^2 + y^2 = 1$ to $[\frac{1}{4}x]^2 + [y-3]^2 = 1$?

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

49. An ellipse is defined by $3x^2 + 2y^2 = k$, and the length of the major axis is 6. What is the value of k ?

- (A) 18
- (B) 27
- (C) 72
- (D) 108

50. In the circle with centre O shown, \overline{RQ} is tangent to the circle at B. What is the measure, in degrees, of $\angle CBR$?



- (A) 50
- (B) 65
- (C) 75
- (D) 90

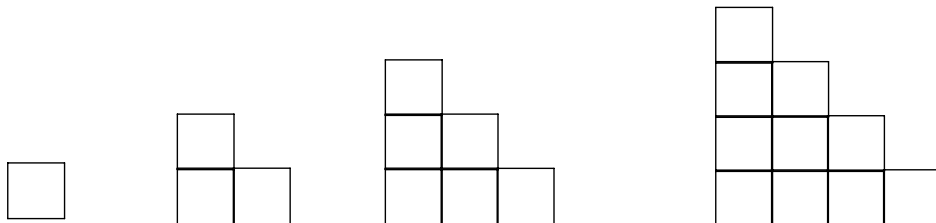
PART II
Total Value: 50%

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

Value

4 51. Algebraically determine the **exact** roots in simplest form for $\frac{1}{x-2} - \frac{2}{x+1} = -1$.

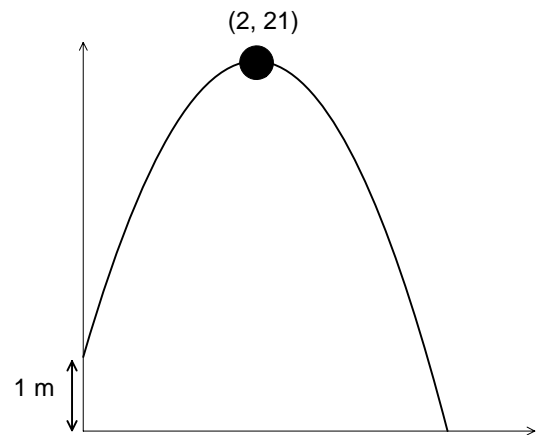
- 4 52. Algebraically determine the quadratic function that models the number of squares in the figures below.



Value

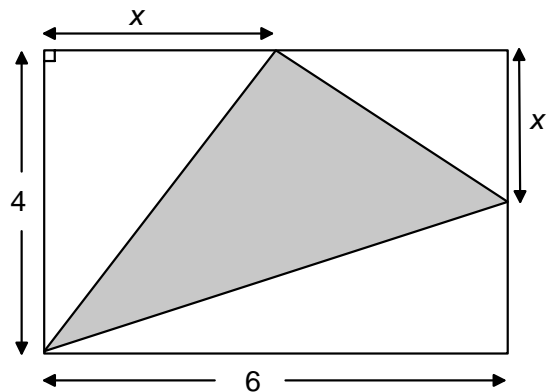
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53. A ball is thrown from an initial height of 1 m and follows a parabolic path as shown. After 2 seconds the ball reaches a maximum height of 21 m. Algebraically determine the quadratic function that models the path followed by the ball, and use it to determine the approximate height of the ball at 3 seconds.



4

54. A rectangular floor, having dimensions 6 m by 4 m, is decorated with a triangular rug as shown. Write a quadratic function that models the uncovered area of the floor and use it to determine the maximum uncovered area.



Value

- 4 55. A volleyball follows a path given by $h(t) = -5t^2 + 10t + 2$, where h is the height in metres and t is the time in seconds since the ball was hit. 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 : $6(2)^{2x} - 11(2)^x = -4$.

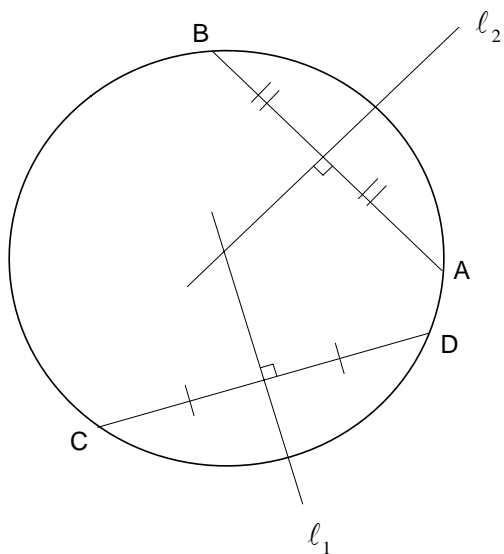
- 4 57. Algebraically solve for x : $\log_3(x^2 - 19) - \log_3(x + 3) = 1$.

Value

- 3 60. In the circle shown, l_1 and l_2 are perpendicular bisectors of chords \overline{CD} and \overline{AB} respectively. Given the equations below for l_1 and l_2 , determine the equation of the circle in standard form if the point $P(3,4)$ lies on the circumference.

$$l_1 : 2x + 3y = -1$$

$$l_2 : x - 5y = -7$$

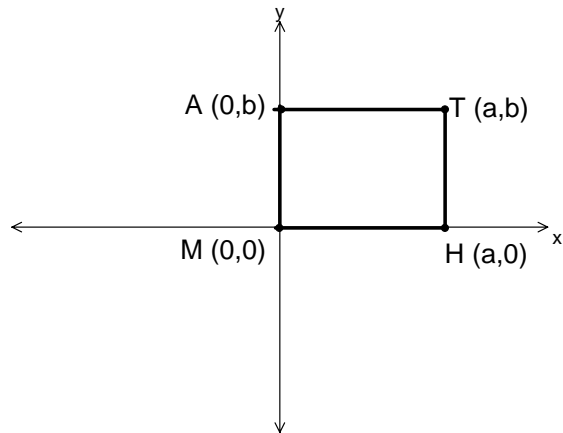


- 3 61. Given the equation $9x^2 + 18x + y^2 + 4 = 0$, state the centre and determine whether the centre lies on the line $3x + 2y - 1 = 0$.

Value

4

62. Using coordinate geometry, prove that the diagonals of figure MATH below are congruent and bisect each other.



4

63. In the circle with centre O shown, determine the area of the shaded region if $\overline{OQ} = 3$ cm and the diameter of the circle is 10 cm.

