

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.

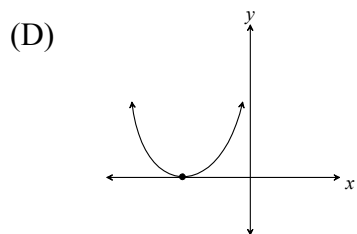
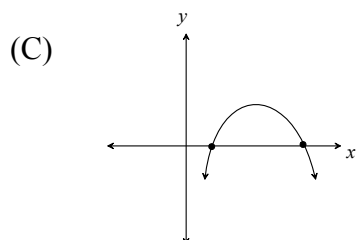
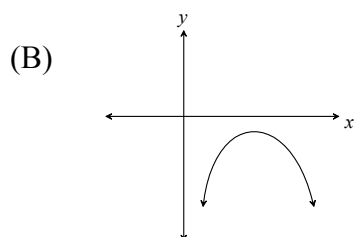
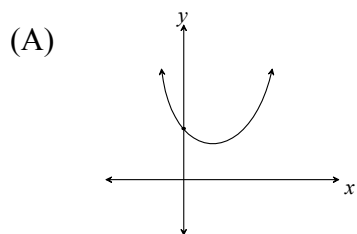
1. What is the mapping rule that will transform $y = x^2$ into the equation $3(y - 5) = (x + 1)^2$?

- (A) $(x, y) \rightarrow (x - 1, \frac{1}{3}y - 5)$
- (B) $(x, y) \rightarrow (x - 1, \frac{1}{3}y + 5)$
- (C) $(x, y) \rightarrow (x + 1, 3y - 5)$
- (D) $(x, y) \rightarrow (x + 1, 3y + 5)$

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

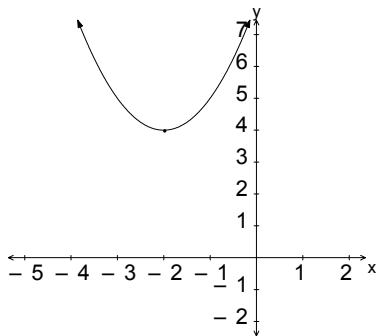
- (A) $\{y \mid y \leq -5, y \in \mathbf{R}\}$
- (B) $\{y \mid y \geq -5, y \in \mathbf{R}\}$
- (C) $\{y \mid y \leq 5, y \in \mathbf{R}\}$
- (D) $\{y \mid y \geq 5, y \in \mathbf{R}\}$

3. A quadratic equation $f(x) = 0$ has a discriminant greater than 0. Which is the graph of $f(x)$?



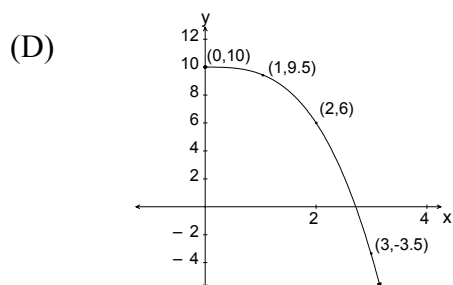
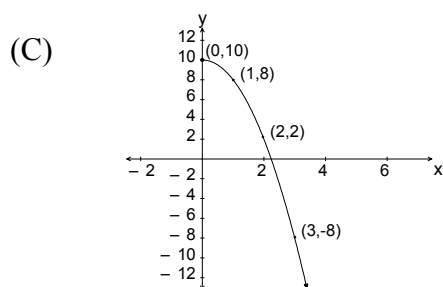
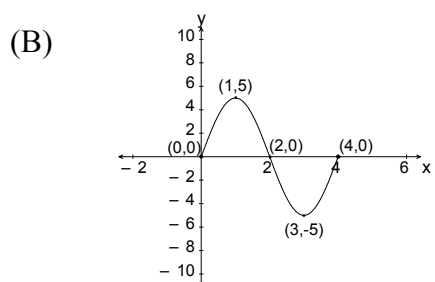
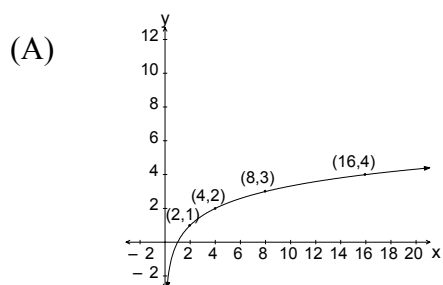
4. What is the vertical stretch factor in $-0.5(y+2) = x^2$ compared to $y = x^2$?
- (A) -2
 - (B) -0.5
 - (C) 0.5
 - (D) 2
5. What characteristics describe the graph of $-\frac{1}{2}(y-2) = x^2$?
- (A) vertex at $(0, -2)$, opens down
 - (B) vertex at $(0, -2)$, opens up
 - (C) vertex at $(0, 2)$, opens down
 - (D) vertex at $(0, 2)$, opens up
6. A quadratic function $f(x)$ has vertex $(7, 0)$ and opens down. What is the nature of the roots of $f(x) = 0$?
- (A) imaginary and equal
 - (B) imaginary and unequal
 - (C) real and equal
 - (D) real and unequal
7. What is the transformational form of $y = -\frac{1}{2}(x-3)^2 + 7$?
- (A) $-2(y-7) = (x-3)^2$
 - (B) $-\frac{1}{2}(y-7) = (x-3)^2$
 - (C) $\frac{1}{2}(y-7) = (x-3)^2$
 - (D) $2(y-7) = (x-3)^2$
8. Which value of 'c' makes $x^2 - 6x + c$ a perfect square?
- (A) -36
 - (B) -9
 - (C) 9
 - (D) 36
9. What are the zeros of the quadratic function $y = 3x^2 - 24$?
- (A) $\pm 2\sqrt{6}$
 - (B) $\pm 2\sqrt{2}$
 - (C) $\pm 2i\sqrt{6}$
 - (D) $\pm 2i\sqrt{2}$

10. Which translation of $y = x^2$ would generate the graph shown?



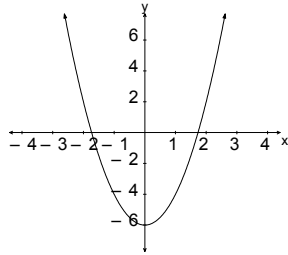
- (A) vertical translation of -4 , horizontal translation of 2
 (B) vertical translation of 4 , horizontal translation of -2
 (C) vertical translation of 4 , horizontal translation of 2
 (D) vertical translation of -4 , horizontal translation of -2

11. Which graph represents a quadratic relationship?

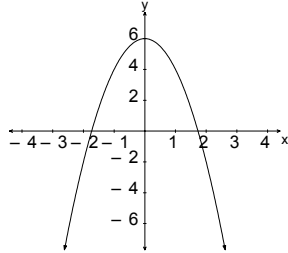


12. Which graph represents the function $y = a(x^2 - 3), a > 0$?

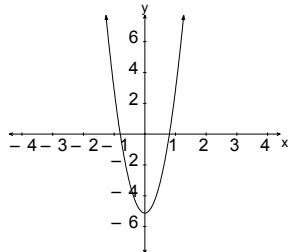
(A)



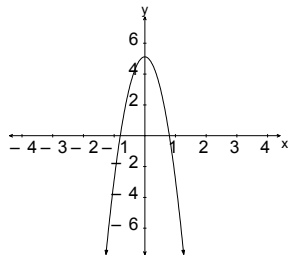
(B)



(C)



(D)



13. What are the roots of $3(x-1)(x+2) = 0$?

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

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

(C) $\{-3, -2, 1\}$

(D) $\{-2, 1, 3\}$

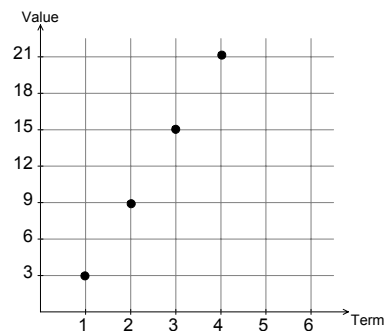
14. The graph of a sequence is shown. What is the common difference between successive terms?

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

(B) 2

(C) 3

(D) 6



15. What is the value of d_2 for the quadratic sequence given by $t_n = 0.5n^2 - 3n + 2$?

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

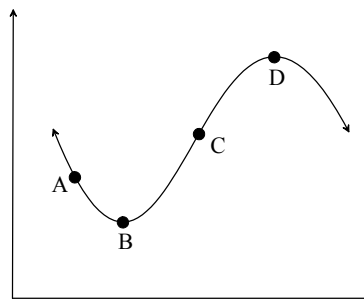
(B) 1

(C) $\frac{3}{2}$

(D) 2

16. At what point would a tangent be drawn to best indicate a negative instantaneous rate of change?

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



17. The table indicates the number of cases of West Nile virus over a 4 month period. What is the average rate of change, in cases per month, between months 2 and 4?

- (A) -9
 (B) $-\frac{1}{9}$
 (C) 4
 (D) 9

month	1	2	3	4
# cases	22	34	30	16

18. You put one penny in a glass jar one day, three pennies the next day, and so on, tripling the number of pennies put in the jar each day thereafter. What type of sequence will this pattern create?

- (A) cubic
 (B) geometric
 (C) quadratic
 (D) quartic

19. What type of function is illustrated in the table shown?

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

x	1	3	5	7
y	3	6	11	18

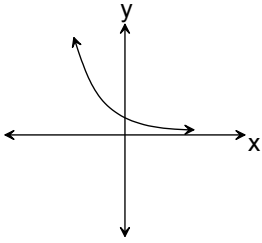
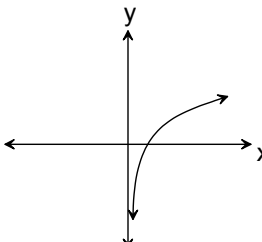
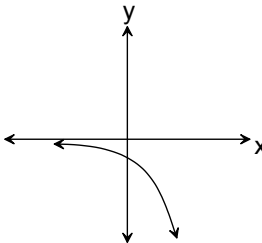
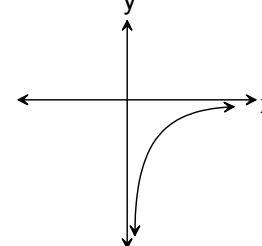
20. Which pattern represents a geometric sequence?

- (A) $\{\frac{1}{3} + 2, \frac{1}{3} + 2 + 2, \frac{1}{3} + 2 + 2 + 2, \dots\}$
 (B) $\{\frac{1}{3} \times 2, \frac{1}{3} \times 3, \frac{1}{3} \times 4, \dots\}$
 (C) $\{\frac{1}{3} \times 2, \frac{1}{3} \times 2 \times 2, \frac{1}{3} \times 2 \times 2 \times 2, \dots\}$
 (D) $\{\frac{1}{3} + 2^1, \frac{1}{3} + 2^2, \frac{1}{3} + 2^3, \dots\}$

21. What is the exponential form of $\log_8 x = \pi$?

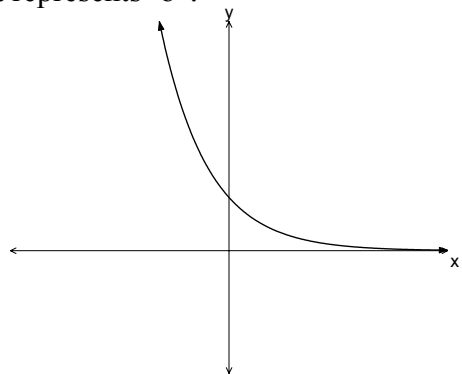
- (A) $8^\pi = x$
- (B) $8^x = \pi$
- (C) $x^\pi = 8$
- (D) $x^8 = \pi$

22. Which graph best represents the inverse of $y = 2^x$?

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

23. Given the graph of $y = a \cdot b^x$ shown, what value best represents 'b'?

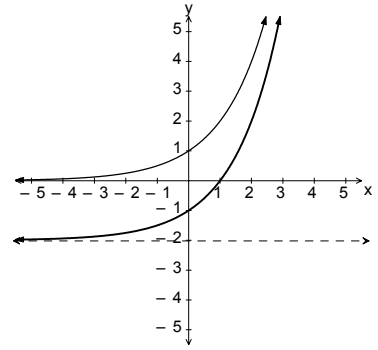
- (A) -2
- (B) $-\frac{1}{2}$
- (C) $\frac{1}{2}$
- (D) 2



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

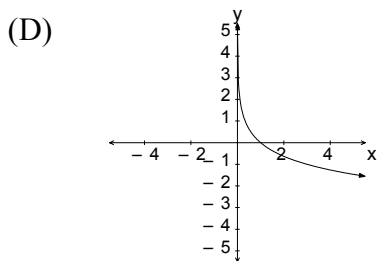
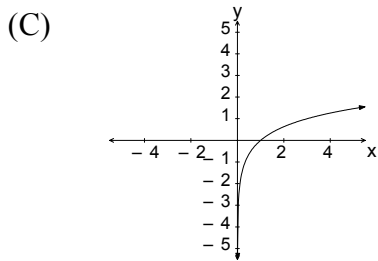
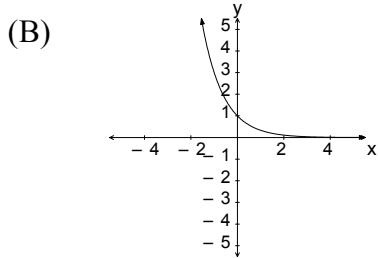
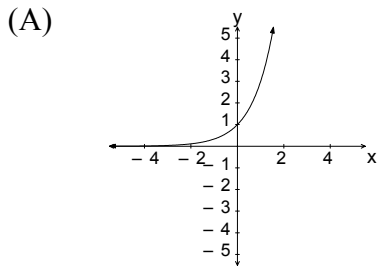
- (A) $y > 0$
- (B) $y < 0$
- (C) $y > 4$
- (D) $y < 4$

25. The graph of $y = 2^x$ and $y = 2^x + k$ is shown. What value represents 'k'?



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

26. Which represents an increasing exponential function?



27. Which expression is equivalent to $\left(\frac{1}{49}\right)^{\frac{x}{2}}$?

- (A) $7^{-\frac{x}{2}}$
- (B) 7^{-x}
- (C) 7^x
- (D) 7^{2x}

28. Solve: $3 \log x = \log 27$

- (A) -3
- (B) 3
- (C) 9
- (D) 81

29. Given $5^x = 12$, which best approximates x ?

- (A) 0.65
- (B) 1.23
- (C) 1.46
- (D) 1.54

30. Which represents an exponential relationship?

(A)

x	1	1.2	1.4	1.6	1.8
y	3	6	8	12	15

(B)

x	1	1.8	2.6	3.4	4.2
y	5.5	7	9.5	13	17.5

(C)

x	1	1.5	2	2.5	3
y	5.5	9	18.5	37	67.5

(D)

x	1	1.1	1.2	1.3	1.4
y	6	36	216	1296	7776

31. Evaluate: $-8^0 + \left(-\frac{2}{5}\right)^{-2}$

- (A) $-\frac{29}{4}$
- (B) $-\frac{21}{25}$
- (C) $\frac{21}{4}$
- (D) $\frac{29}{4}$

32. Solve for x : $\log_8 16 - \log_8 2 - \log_8 4 = x$

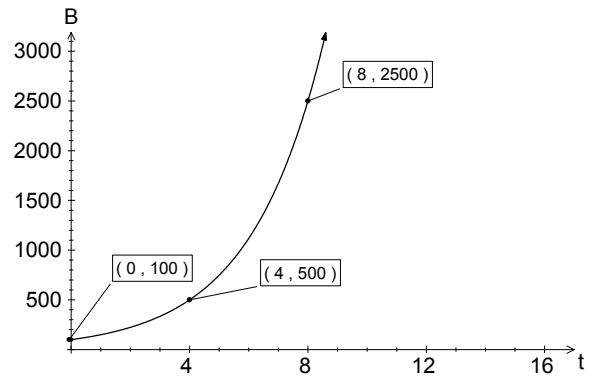
- (A) $\frac{1}{3}$
- (B) $\log_8 4$
- (C) 1
- (D) $\log_8 32$

33. Solve: $9^{3x-1} = 81^{-x+1}$

- (A) $\frac{3}{10}$
- (B) $\frac{2}{5}$
- (C) $\frac{1}{2}$
- (D) $\frac{3}{5}$

34. Which function describes this data?

- (A) $B = 100(4)^{\frac{t}{5}}$
- (B) $B = 100(4)^{\frac{5}{t}}$
- (C) $B = 100(5)^{\frac{t}{4}}$
- (D) $B = 100(5)^{\frac{4}{t}}$



35. Which is equivalent to $\frac{1}{\sqrt[3]{25}}$

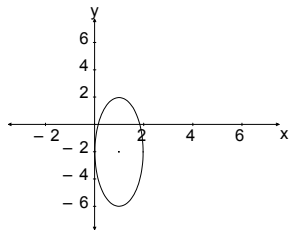
- (A) 5^{-6}
- (B) $5^{-\frac{2}{3}}$
- (C) $5^{\frac{2}{3}}$
- (D) 5^6

36. A radioactive isotope has a half-life of 3000 years. If a sample of this isotope originally has mass 30 g, which models the mass of this sample over time?

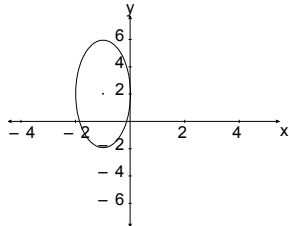
- (A) $\frac{1}{3000}(y) = 30\left(\frac{1}{2}\right)^x$
- (B) $\frac{1}{30}(y - 3000) = \left(\frac{1}{2}\right)^x$
- (C) $y = 30\left(\frac{1}{2}\right)^{\frac{x}{3000}}$
- (D) $y = 3000\left(\frac{1}{2}\right)^{\frac{x}{30}}$

37. Which is the graph of $(x-1)^2 + \left[\frac{1}{4}(y+2)\right]^2 = 1$?

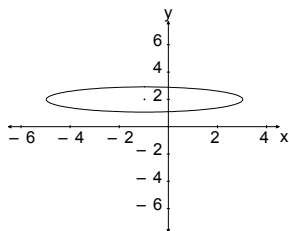
(A)



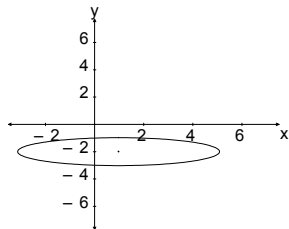
(B)



(C)



(D)



38. Which is the converse of:

“If a diameter bisects an inscribed angle in a circle, then the diameter bisects the arc subtending the inscribed angle.” ?

- (A) If a diameter bisects an inscribed angle in a circle, then the arc subtending the inscribed angle bisects the diameter.
- (B) If the diameter of a circle bisects the arc subtending an inscribed angle, then the diameter bisects the inscribed angle.
- (C) If a line bisects an arc subtending an inscribed angle, then it bisects the inscribed angle in the circle.
- (D) If the diameter of a circle does not bisect the arc subtending an inscribed angle, then the diameter does not bisect the inscribed angle.

39. Which represents a circle?

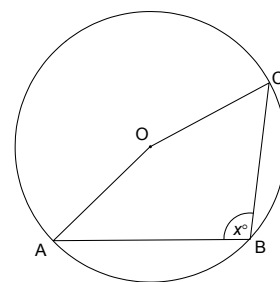
(A) $\left[\frac{1}{4}(x+3)\right]^2 - \left[\frac{1}{2}(y-1)\right]^2 = 1$

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

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

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

40. In the circle with centre O shown, $m\widehat{ABC} = 170^\circ$. What is the value of x in degrees?



(A) 85

(B) 90

(C) 95

(D) 100

41. If a point P (1, 0) is rotated 120° from standard position on a unit circle, what are the new coordinates of P?

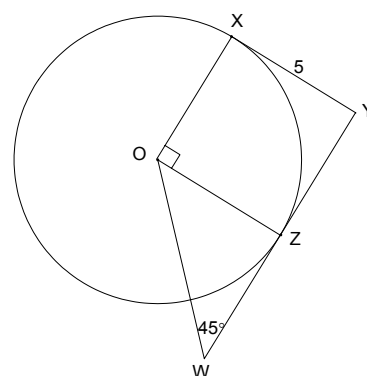
(A) $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

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

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

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

42. Points X and Z lie on the circle with centre O, \overline{YW} is tangent to the circle at Z, and \overline{YX} is tangent to the circle at X as shown. What is the length of \overline{OW} ?



(A) 5

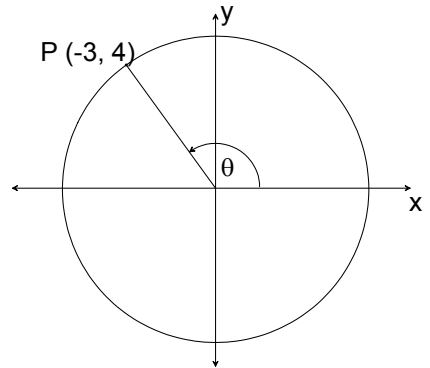
(B) $5\sqrt{2}$

(C) $5\sqrt{3}$

(D) 10

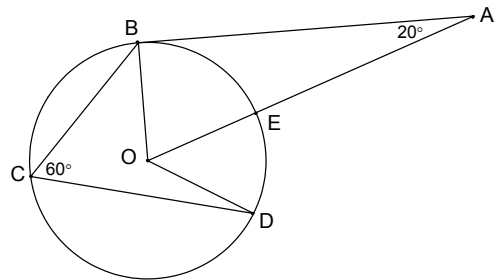
43. Given point P rotated through an angle θ from standard position as shown, which equation is true?

- (A) $\sin \theta = \frac{4}{5}$
 (B) $\sin \theta = -\frac{4}{3}$
 (C) $\cos \theta = \frac{4}{5}$
 (D) $\cos \theta = -\frac{4}{3}$



44. In this circle with centre O, \overline{AB} is tangent to the circle at B. What is the measure of $\angle EOD$ in degrees?

- (A) 50
 (B) 70
 (C) 80
 (D) 120



45. What is the radius of the circle with equation $x^2 + y^2 + 8y - 9 = 0$?

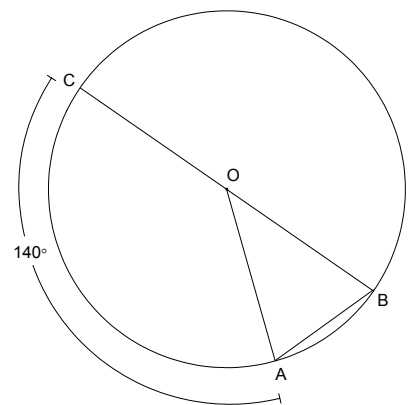
- (A) 3
 (B) 5
 (C) 9
 (D) 25

46. The endpoints of a diameter of a circle are $P(-2, 7)$ and $Q(6, 5)$. What is the centre of the circle?

- (A) $(-8, 2)$
 (B) $(2, 6)$
 (C) $(4, 12)$
 (D) $(6, 2)$

47. In this circle with diameter \overline{BC} and centre O, what is the measure of $\angle BAO$ in degrees?

- (A) 35
 (B) 40
 (C) 60
 (D) 70

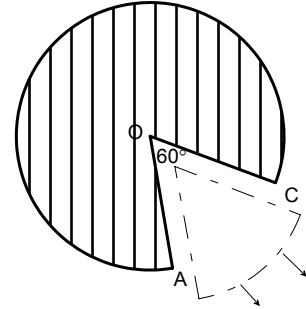


48. Which mapping rule would transform $x^2 + y^2 = 1$ to $\left[\frac{1}{9}x\right]^2 + (y+2)^2 = 1$?

- (A) $(x, y) \rightarrow \left(\frac{1}{9}x, y-2\right)$
- (B) $(x, y) \rightarrow \left(\frac{1}{9}x, y+2\right)$
- (C) $(x, y) \rightarrow (9x, y-2)$
- (D) $(x, y) \rightarrow (9x, y+2)$

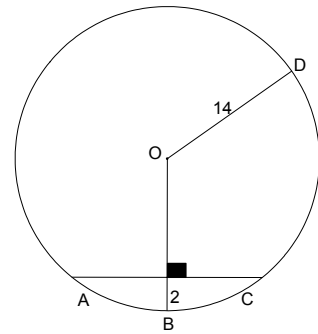
49. Sector AOC is cut from a circle with radius 12 cm as shown. What is the approximate perimeter, in cm, of the remaining region shown?

- (A) 63
- (B) 75
- (C) 87
- (D) 99



50. In this circle with centre O, what is the length of chord \overline{AC} ?

- (A) $2\sqrt{13}$
- (B) $2\sqrt{15}$
- (C) $4\sqrt{13}$
- (D) $4\sqrt{15}$



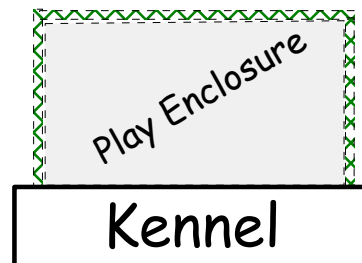
PART II
Total Value: 50%

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

Value

4 51. Algebraically determine the **EXACT** roots in simplest form for $\frac{5}{x-3} = \frac{x}{x+1}$.

- 4 52. A rectangular play enclosure for some dogs is to be made with 60 m of fencing using the kennel as one side of the enclosure as shown. Algebraically determine the quadratic function that models the area of the enclosure and use it to find the dimensions that produce the maximum area.



- 4 53. A baseball player hits a ball into the air. The ball's height above the ground, in metres, t seconds after being hit, is approximated by $h(t) = 1 + 13t - 5t^2$. Algebraically determine the time when the ball first reaches a height of 9 m.

- 4 54. The power P , in watts, supplied to a circuit by a battery is given by the formula $P = 6I - 0.5I^2$, where I is the current in amperes. What is the approximate instantaneous rate of change of power when the current is 4 amperes?

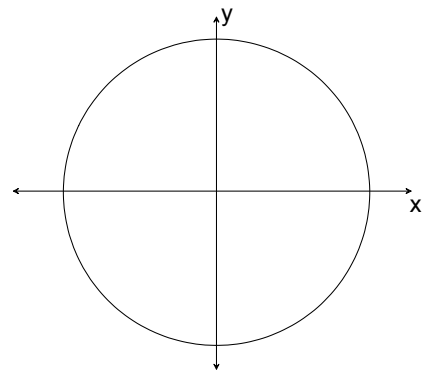
3 55. Solve: $25^{2x+1} - 5 = 120$.

4 56. Solve: $\frac{1}{3}\log_3 27 + \log_3 x = 4^{\frac{1}{2}}$.

4 57. If a Honda Prelude bought in 2000 cost \$32 000 and depreciates at a rate of 20% per year, and a Chevrolet Corvette bought in 1994 cost \$43 000 and depreciates at a rate of 15% per year, algebraically determine which car is worth more in 2005.

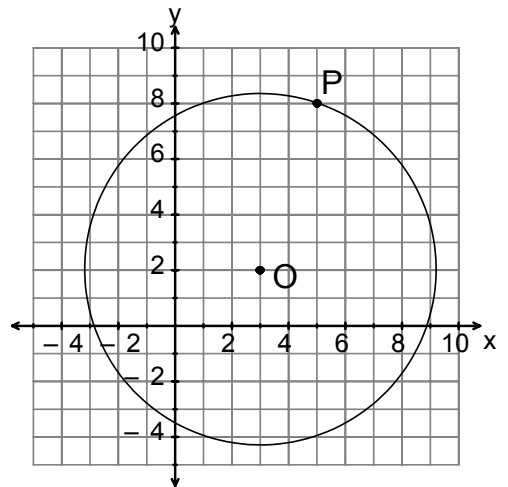
- 4 58. Suppose there are 25 coyotes in one area of NL right now. If this population is known to triple every 4 years, how long will it take for the population to reach 258 animals?

- 3 59. A point P having coordinates $(0.5736, -0.8192)$, lies on the terminal arm of an angle in standard position on a unit circle. Sketch this situation on the axes provided and determine the value of θ in degrees.

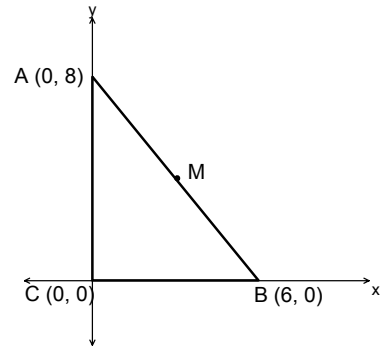


- 4 60. Write $x^2 + y^2 - 6x + 4y - 12 = 0$ in transformational form and state the radius.

- 4 61. Determine the equation of the circle in standard form having centre O, and point P on the circumference, as shown.



- 4 62. Given the diagram as shown, use coordinate geometry to prove that the midpoint of the hypotenuse, M, is an equal distance from A, B, and C.



- 4 63. In this circle with centre O, determine the total area of the shaded regions.

