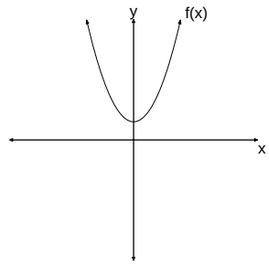
PART I
Total Value: 50%

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 mark.

1. What is the range of $-\frac{1}{5}(y+1)=(x-4)^2$?

   (A) $\{y \mid y \leq -1, y \in \mathrm{R}\}$
   (B) $\{y \mid y \geq -1, y \in \mathrm{R}\}$
   (C) $\{y \mid y < -1, y \in \mathrm{R}\}$
   (D) $\{y \mid y > -1, y \in \mathrm{R}\}$

2. If the graph of a quadratic function $f(x)$ is as shown, which is a possible value of the discriminant for the equation $f(x)=0$?



   (A) -1
   (B) 0
   (C) $\frac{1}{2}$
   (D) 1

3. Compared to the graph of $y=x^2$, which quadratic has a graph with a vertical stretch factor of $\frac{1}{3}$?

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

4. What is the equation of the axis of symmetry for $y=2x-x^2+1$?

   (A) $x=\frac{1}{4}$
   (B) $x=\frac{1}{2}$
   (C) $x=1$
   (D) $x=2$

5. A quadratic function $f(x)$ has vertex $(2,3)$ and opens downward. Which describes the roots of $f(x)=0$?

   (A) imaginary and equal
   (B) imaginary and unequal
   (C) real and equal
   (D) real and unequal

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

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

7. What is the second level difference for the quadratic relation illustrated in the table?

x	-1	0	1	2
y	0	-1	2	9

(A) 0
(B) 2
(C) 3
(D) 4

8. What is the standard form of $4(y-1)=(x+3)^2$?

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

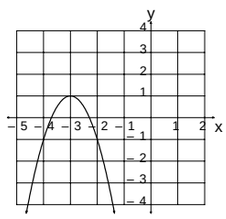
9. What is the transformational form of $y=x^2-8x$?

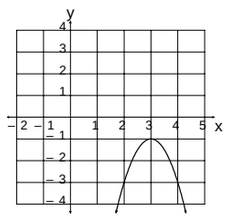
(A) $(y-64)=(x-4)^2$
(B) $(y-16)=(x-4)^2$
(C) $(y+16)=(x-4)^2$
(D) $(y+64)=(x-4)^2$

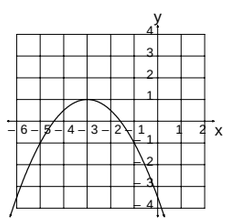
10. If $f(x)=2x^2+64$, what are the roots of $f(x)=0$?

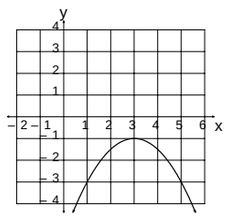
(A) $\pm 2\sqrt{2}$
(B) $\pm 2i\sqrt{2}$
(C) $\pm 4\sqrt{2}$
(D) $\pm 4i\sqrt{2}$

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

(A) 

(B) 

(C) 

(D) 

12. Which represents a quadratic relationship?

(A)

x	0	1	2	3	4
y	6	7	8	9	10

(B)

x	0	2	4	6	8
y	2	5	14	29	50

(C)

x	0	1	2	3	4
y	1	3	9	27	81

(D)

x	0	2	4	6	8
y	0	2	16	54	128

13. The graph of which function has x-intercepts of $\left(\sqrt{5}, 0\right)$ and $\left(-\sqrt{5}, 0\right)$?

(A) $y = -2x^2 - 10$
(B) $y = -2x^2 + 10$
(C) $y = 2x^2 + 10$
(D) $y = 2x^2 - 10$

14. Solve: $2x + x^2 = x$.

(A) $\{-1\}$
(B) $\{-1, 1\}$
(C) $\{0, -1\}$
(D) $\{0\}$

15. For the sequence shown, what is t_n? $\left\{1, \frac{3}{2}, 2, \frac{5}{2}, 3, \ldots\right\}$

(A) $t_n = \frac{1}{2}n - \frac{1}{2}$
(B) $t_n = \frac{3}{2}n - \frac{1}{2}$
(C) $t_n = \frac{3}{2}n + \frac{1}{2}$
(D) $t_n = \frac{1}{2}n + \frac{1}{2}$

16. Which best describes instantaneous rate of change?

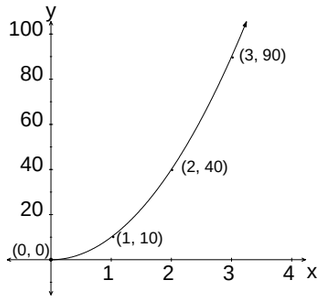
(A) slope of an asymptote to a curve
(B) slope of a perpendicular to a curve
(C) slope of a secant to a curve
(D) slope of a tangent to a curve

17. The Department of Fisheries and Oceans recorded the temperature on the Torrent River over 5 days as illustrated in the table below. Which represents the average rate of change in temperature between days 1 and 5 in °C per day ?

Day	Temperature in °C
1	14
2	15
3	17
4	20
5	22

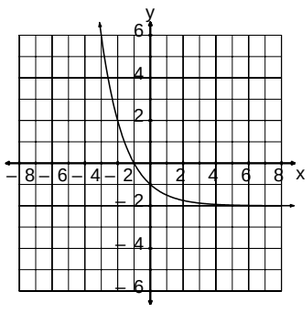
(A) -2
(B) $-\frac{1}{2}$
(C) $\frac{1}{2}$
(D) 2

18. What type of function is illustrated by the graph shown?



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

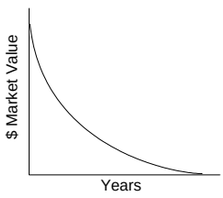
19. Which describes the graph shown?



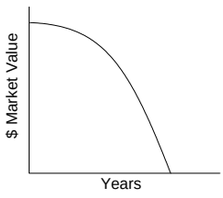
(A) exponential decay, asymptote $y = -2$
(B) exponential decay, asymptote $x = -2$
(C) exponential growth, asymptote $y = -2$
(D) exponential growth, asymptote $x = -2$

20. Which models a situation where the market value of a house appreciates by 3% annually?

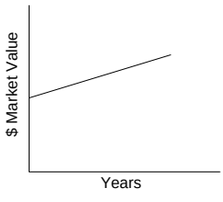
(A)



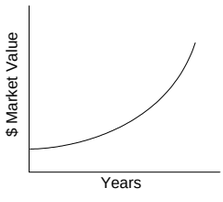
(B)



(C)

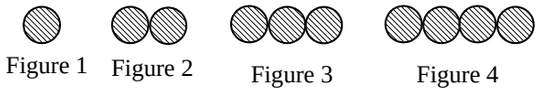


(D)

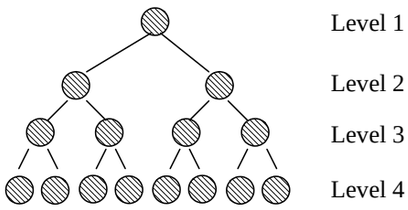


21. Which pattern represents an exponential sequence?

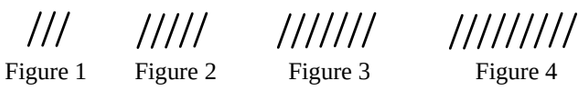
(A)



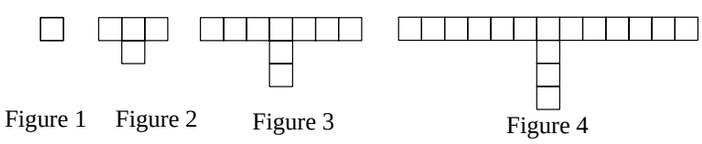
(B)



(C)



(D)



22. Solve: $\log_2 8 - \log_2 4 = x$.

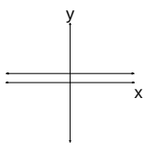
(A) 1
(B) 2
(C) 3
(D) 5

23. Which is the inverse of $y = 5^x$?

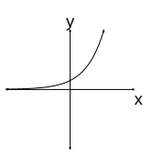
(A) $y = \log_5 x$
(B) $\log_5 y = x$
(C) $y = \log_x 5$
(D) $\log_y 5 = x$

24. Which graph represents an exponential function $f(x) = ab^x$ with $b = \frac{2}{3}$?

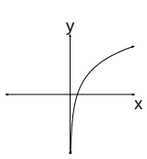
(A)



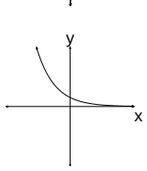
(B)



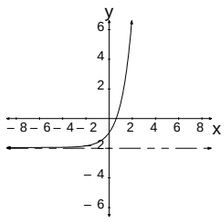
(C)

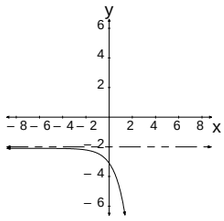


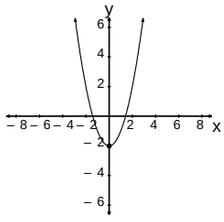
(D)

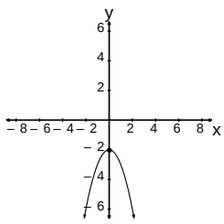


25. Which relation has a range of $\{y \mid y > -2, y \in \mathrm{R}\}$?

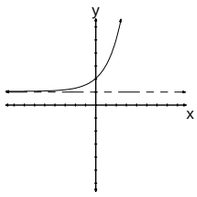
(A) 

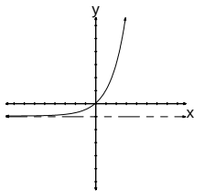
(B) 

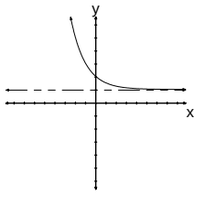
(C) 

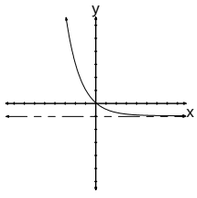
(D) 

26. Which graph represents $y = b^x + c,\ 0 < b < 1,\ c < 0$?

(A) 

(B) 

(C) 

(D) 

27. Which is equivalent to $\frac{8^{2x}(4)}{2^x}$?

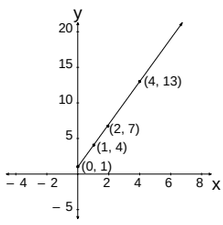
(A) 2^{9x}
(B) 2^{4x+2}
(C) 2^{11x}
(D) 2^{5x+2}

28. Solve: $4^{3x+1} = \sqrt{2}$.

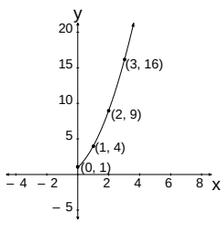
(A) $-\frac{1}{12}$
(B) $-\frac{1}{4}$
(C) $\frac{1}{6}$
(D) $\frac{5}{12}$

29. Which best represents an exponential relationship?

(A)



(B)



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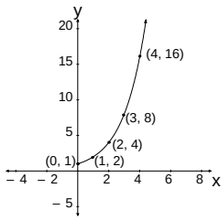

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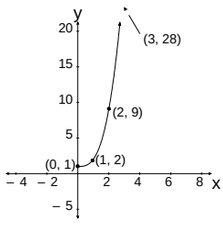


30. Given $7^x = 14$, which best approximates *x*?

(A) 1.15
(B) 1.36
(C) 2
(D) 7

31. Evaluate: $\left[\left(\frac{81}{16}\right)^{\frac{1}{4}} - \left(\frac{1}{3}\right)^{0}\right]^{-2}$.

(A) $\frac{1}{4}$
(B) $\frac{4}{25}$
(C) $\frac{25}{4}$
(D) $\frac{4}{1}$

32. Solve: $\log_3 27 + \log_3 9 - \log_3 81 = \log_3 x$.

(A) $\frac{1}{9}$
(B) $\frac{1}{3}$
(C) 1
(D) 3

33. Solve: $5^{2x-1} = 3^{x}$.

(A) 0.37
(B) 0.66
(C) 0.76
(D) 1.32

34. An antique automobile valued at $10 000 appreciates 12% in value over 5 years. Should this appreciation rate continue, which function represents the value of the automobile, *V*, after *t* years?

(A) $V = 10\,000(12)^{\frac{t}{5}}$
(B) $V = 10\,000(12)^{5t}$
(C) $V = 10\,000(1.12)^{\frac{t}{5}}$
(D) $V = 10\,000(1.12)^{5t}$

35. Evaluate: $\left(\frac{1}{64}\right)^{-\frac{2}{3}}$.

(A) $\frac{1}{512}$
(B) $\frac{1}{16}$
(C) 16
(D) 512

36. Which statement corresponds with $y = 50(1.3)^{\frac{x}{2}}$?

(A) An investment of $50 decreases by 30% every two years.
(B) An investment of $50 increases by 30% every two years.
(C) 50 g of a radioactive substance has a half-life of 1.3 years.
(D) 50 g of a radioactive substance has a half-life of 130 years.

37. Which represents an ellipse?

(A) $4x^2 + 4y^2 - 9y = 225$
(B) $10x^2 + 10y^2 + 4x + 2y - 144 = 0$
(C) $12x^2 + 20y^2 + 12x + 20y = 256$
(D) $2x^2 + 2y = 36$

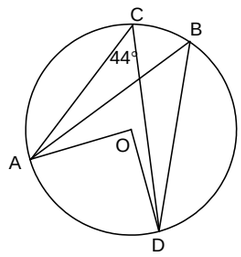
38. What transformations of $x^2 + y^2 = 1$ result in the equation $\left[\frac{1}{2}(x+2)\right]^2 + \left[\frac{1}{3}(y-1)\right]^2 = 1$?

(A) HS factor 2, VS factor 3, HT 2 units left, VT 1 unit up
(B) HS factor $\frac{1}{2}$, VS factor $\frac{1}{3}$, HT 2 units left, VT 1 unit up
(C) HS factor 2, VS factor 3, HT 2 units right, VT 1 unit down
(D) HS factor $\frac{1}{2}$, VS factor $\frac{1}{3}$, HT 2 units right, VT 1 unit down

39. Which is the converse of: "Two minor arcs are congruent if their central angles are congruent."?

(A) Two minor arcs are not congruent *iff* their central angles are not congruent.
(B) Two central angles are congruent if their minor arcs are congruent.
(C) Two central angles are not congruent if their minor arcs are congruent.
(D) Two minor arcs are congruent *iff* their central angles are congruent.

40. In the circle with centre O shown, $\angle C = 44°$. What is the measure of minor arc $\overset{\frown}{AD}$ in degrees?

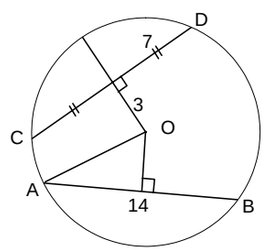


(A) 22
(B) 44
(C) 88
(D) 272

41. If the point $P(24, -7)$ is on the terminal arm of θ in standard position, approximately what is θ in degrees?

(A) 16.3
(B) 106.3
(C) 286.3
(D) 343.7

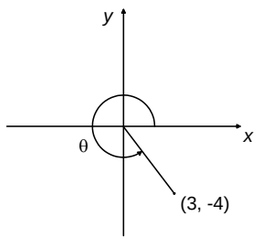
42. In the circle with centre O shown, what is the approximate length of $\overline{AO}$?



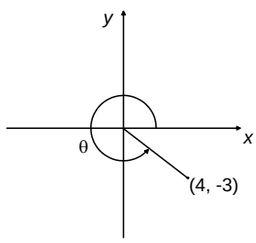
(A) 6.3
(B) 7.6
(C) 12.1
(D) 13.7

43. Which point, rotated through an angle θ from standard position, produces $\sin\theta = \frac{-3}{5}$ when $0° \le \theta \le 360°$?

(A)



(B)



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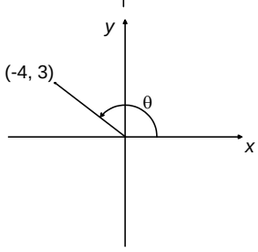
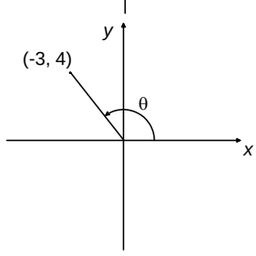
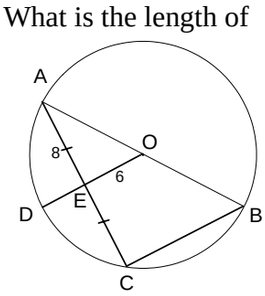


(D)



44. In the circle with centre O shown, AE = 8, OE = 6, and $\overline{AE}$ = $\overline{CE}$. What is the length of $\overline{CB}$?



(A) 8
(B) 8.5
(C) 12
(D) 25.6

45. Which shows the equation $9x^2 + 25(y-1)^2 = 225$ in transformational form?

(A) $\left[\frac{1}{25}x\right]^2 + \left[\frac{1}{9}(y-1)\right]^2 = 1$

(B) $\left[\frac{1}{5}x\right]^2 + \left[\frac{1}{3}(y-1)\right]^2 = 1$

(C) $\frac{9}{225}x^2 + \frac{25}{225}(y-1)^2 = 1$

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

46. If $\overline{AB}$ and $\overline{CD}$ are perpendicular bisectors of each other, and $\overline{CD}$ has endpoints $C(5,-2)$ and $D(-13,12)$, what is the point of intersection?

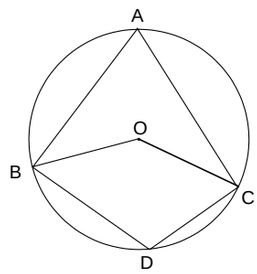
(A) $(-9, 7)$

(B) $(-4, 5)$

(C) $(4, -5)$

(D) $(9, -7)$

47. If A, B, C, and D are points on the circle with centre O, and $\angle BOC = 140°$, what is $m\angle BDC$ in degrees?

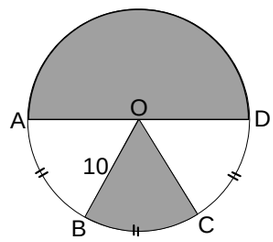


(A) 100
(B) 110
(C) 140
(D) 150

48. Which equation represents the circle $x^2 + y^2 = 1$ after it is transformed according to the mapping rule $(x, y) \rightarrow \left(4x - 2, \frac{1}{2}y + 3\right)$?

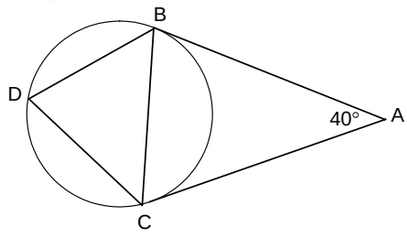
(A) $\left[4(x-2)\right]^2 + \left[\frac{1}{2}(y+3)\right]^2 = 1$
(B) $\left[\frac{1}{4}(x+2)\right]^2 + \left[2(y-3)\right]^2 = 1$
(C) $\left[4(x+2)\right]^2 + \left[\frac{1}{2}(y-3)\right]^2 = 1$
(D) $\left[\frac{1}{4}(x-2)\right]^2 + \left[2(y+3)\right]^2 = 1$

49. Given this circle with centre O as shown, and $\overset{\frown}{AB} = \overset{\frown}{BC} = \overset{\frown}{CD}$, what is the approximate total area, in square units, of the shaded regions?



(A) 41.9
(B) 52.4
(C) 209.4
(D) 261.8

50. If B, C, and D are points on the circle as shown, and $\overline{AB}$ and $\overline{CD}$ are tangents to the circle at B and C respectively, what is the $m\angle BDC$ in degrees?



(A) 20
(B) 40
(C) 70
(D) 80

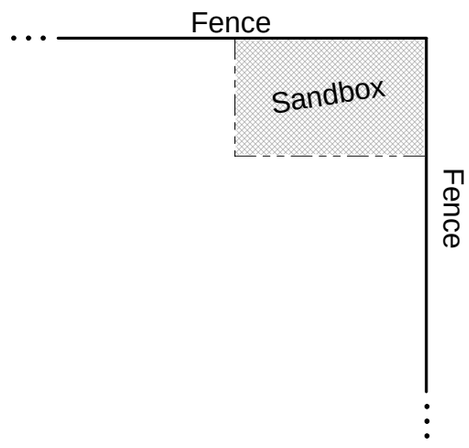
PART II
Total Value: 50%

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

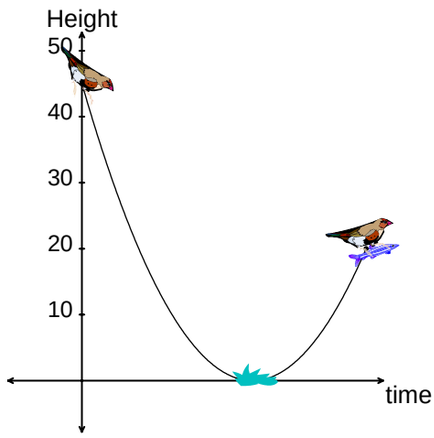
Value

4 51. Algebraically determine the **EXACT** roots in simplest form for $16x(x+1) = -13$.

4 52. A day care centre bought 20 m of board to form two sides of a rectangular sandbox against a corner in a fenced yard as shown. If all 20 m of board is used, write the quadratic function that models the area of the sandbox, and use it to determine the maximum area the sandbox can have.



4 53. An osprey dives toward the water to catch a salmon. Its height above the water, in metres, t seconds after it begins its dive, is approximated by $h(t) = 5t^2 - 30t + 45$. Algebraically determine the time it takes the osprey to reach a return height of 20 m as shown.

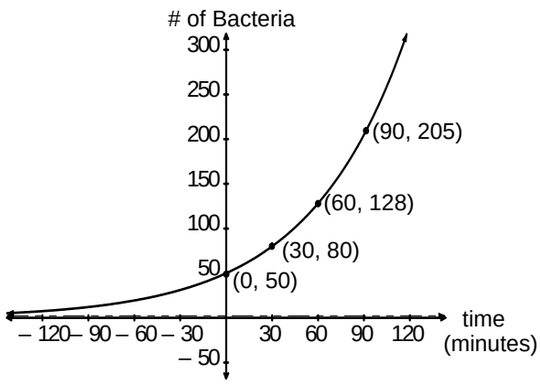


4 54. The volume of water at a given time in a 2000 L tank is represented by the formula $V = 2000\left(1 - \frac{t}{45}\right)^2$, where t is time in minutes. Determine the average rate of change in the volume of water in the tank from minute 0 to minute 10, and use it to describe how the volume of water in the tank is changing during that time.

3 55. Algebraically solve: $\left(\frac{1}{4}\right)^{3-x} = 64^{x+1}$.

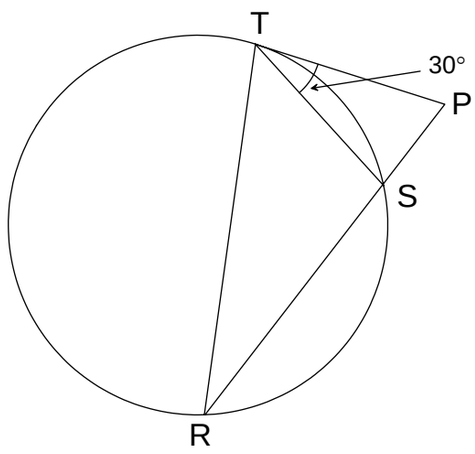
4 56. Write as a single logarithm and approximate the value to the nearest hundredth:
$2\log_5 3 + \log_5 96 - \frac{1}{3}\log_5 64$.

4 57. A university student studied and recorded the population of a bacterial culture every 30 minutes, as shown on the graph. Determine the exponential function that models the bacteria population during the study, and use it to find the bacteria population 180 minutes after the study began.



4 58. Technetium-99, a radioactive isotope used in nuclear medicine, has a half-life of 6 hours. Set up an equation, and use it to determine how long it would take for 500 micrograms of Technetium-99 to reduce to 100 micrograms.

3 59. If $\overline{TP}$ is tangent to the circle, $\overset{\frown}{RS} = 100°$, and $\angle PTS = 30°$, determine the measure of $\angle TRS$, $\angle RTS$, and $\angle TPS$.

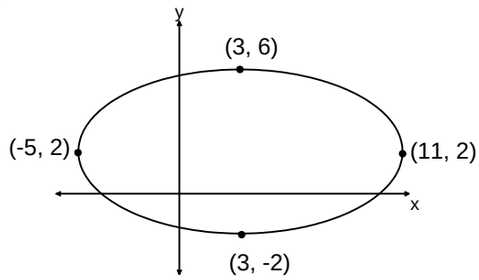


4 60. Write $x^2 + y^2 + 6x - 8y + 9 = 0$ in standard form and state the radius and centre.

Radius:

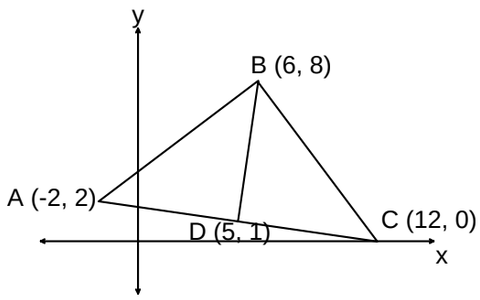
Centre:

4 61. Determine the equation in transformational form of the ellipse shown, and state the lengths of the major and minor axes.



Major Axis Length:
Minor Axis Length:

4 62. Given ΔABC as shown, use coordinate geometry to prove $\overline{BD}$ is the perpendicular bisector of $\overline{AC}$.



4 63. In the circle with centre at the origin as shown, determine the measure of angle θ and use it to find the approximate area of the shaded region.