PART I
Total Value: 50%

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

1. 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

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

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

3. The graph of which quadratic function has x-intercepts of $(-6, 0)$ and $(2, 0)$ and a minimum value of -7?

(A) $-\frac{16}{7}(y-7) = (x-2)^2$
(B) $-\frac{16}{7}(y+7) = (x+2)^2$
(C) $\frac{16}{7}(y-7) = (x-2)^2$
(D) $\frac{16}{7}(y+7) = (x+2)^2$

4. Solve: $8x^2 - 8x - 7 = 0$.

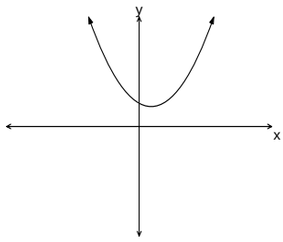
(A) $\frac{1 \pm 3\sqrt{2}}{2}$
(B) $\frac{1 \pm 12\sqrt{2}}{2}$
(C) $\frac{2 \pm 3\sqrt{2}}{2}$
(D) $\frac{2 \pm 3\sqrt{2}}{4}$

5. What values of b will make $x^2 + bx + 10$ a perfect square trinomial?

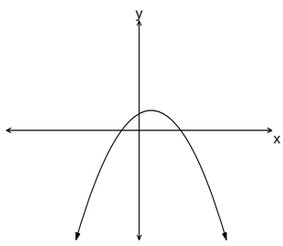
(A) $\pm\sqrt{10}$
(B) $\pm 2\sqrt{10}$
(C) ± 20
(D) ± 25

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

(A)



(B)



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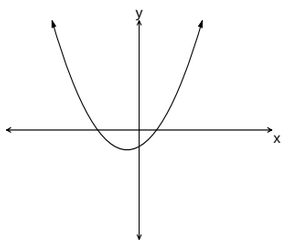

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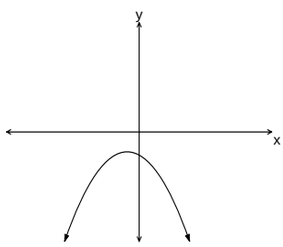


7. What is the standard form of $\frac{1}{2}(y+25)=(x-5)^2$?

(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. 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

9. A quadratic equation is given by $y=3x^2+bx+1$. What is the value of b if the equation of the axis of symmetry is $x=-7$?

(A) -42
(B) -21
(C) 21
(D) 42

10. What is the sum of the roots of $3x^2 + (k-1)x + 10 = 0$?

(A) $\frac{k-1}{3}$

(B) $\frac{-k+1}{3}$

(C) $\frac{-10}{3}$

(D) $\frac{10}{3}$

11. For what value(s) of k will $f(x) = x^2 + kx + k + 15$ have two different real roots?

(A) $-6 < k < 10$

(B) $-6 \le k \le 10$

(C) $k < -6$ or $k > 10$

(D) $k \le -6$ or $k \ge 10$

12. 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

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 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) $3(y-2) = x^2$

15. What is the value of D_3 if $t_n = -\frac{1}{2}n^3 + 3n^2 - 5n + 4$?

(A) -3

(B) -1

(C) 1

(D) 3

16. What is the range of $y = -3x^2 + 24x - 11$?

(A) $\{y \mid y \le -11, y \in R\}$

(B) $\{y \mid y \ge -11, y \in R\}$

(C) $\{y \mid y \le 37, y \in R\}$

(D) $\{y \mid y \ge 37, y \in R\}$

17. Solve: $3\sqrt{5}\,x^2 - \sqrt{5}\,x = 0$.

(A) $\{0\}$

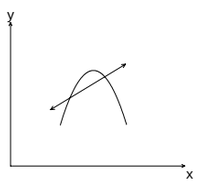
(B) $\left\{\frac{1}{3}\right\}$

(C) $\left\{0, \frac{1}{3}\right\}$

(D) $\left\{0, \frac{1}{3}, \sqrt{5}\right\}$

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

(A)



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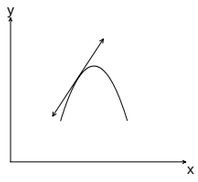

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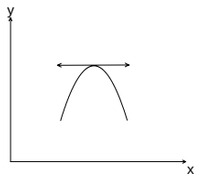
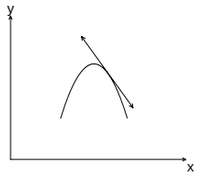


(D)



19. A flashlight projects a circular image of radius 15 cm onto a wall. The radius of the circular image decreases at a rate of 30 mm/s as the flashlight is moved closer to the wall. Which function describes the area of the circular image at a given instant?

(A) $A = \pi(15 - 3t)^2$

(B) $A = \pi(15 - 30t)^2$

(C) $A = \pi(15 - 3t^2)$

(D) $A = \pi(15 - 30t^2)$

20. 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) $\{y \mid y \geq -5, y \in R\}$

21. Which mapping rule will transform $y = 2^x$ to $-\frac{1}{4}(y+1) = 2^{2x-6}$?

(A) $(x, y) \rightarrow \left(-\frac{1}{2}x + 3, -4y - 1\right)$

(B) $(x, y) \rightarrow \left(-\frac{1}{2}x + 6, -4y - 1\right)$

(C) $(x, y) \rightarrow \left(\frac{1}{2}x + 3, -4y - 1\right)$

(D) $(x, y) \rightarrow \left(\frac{1}{2}x + 6, -4y - 1\right)$

22. 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)

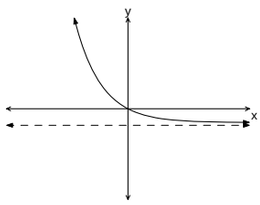
x	0	1	2	3	4
y	0	7	16	27	40

(D)

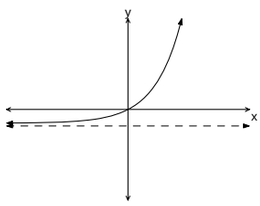
x	0	4	8	12	16
y	5	117	965	3317	7941

23. Which graph represents $y = ab^{\frac{x}{c}} + d$, where $a > 1, 0 < b < 1, c = 1$, and $d < 0$?

(A)



(B)



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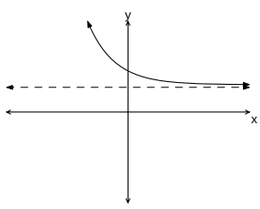
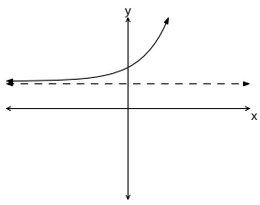


(D)



24. What are the coordinates of the focal point for $\frac{1}{3}(y-1) = 2^{x-2}$?

(A) $(-2, 0)$

(B) $(0, 1)$

(C) $\left(0, \frac{7}{4}\right)$

(D) $(2, 4)$

25. Simplify: $\left(2x^{\frac{1}{2}} - x^{-\frac{1}{2}}\right)^2$.

(A) $\frac{2x^2 - 1}{x}$

(B) $\frac{4x^2 - 1}{x}$

(C) $\frac{4x^2 - 4x + 1}{x}$

(D) $\frac{4x^2 + 4x - 1}{x}$

26. Solve: $2^x\left(8^{x^2+2}\right) = 256$.

(A) $\left\{\frac{2}{3}\right\}$

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

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

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

27. Simplify: $\frac{\left(3x^3\right)^2}{81x^{-4}y^{-2}}$.

(A) $\frac{x^2y^2}{27}$

(B) $\frac{x^2y^2}{9}$

(C) $\frac{x^{10}y^2}{27}$

(D) $\frac{x^{10}y^2}{9}$

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

(A) 3^{5x}

(B) 3^{7x}

(C) 3^{x+3}

(D) 3^{3x+3}

29. Solve: $\left(\frac{1}{625}\right)^{x-1} = \sqrt[3]{5}$.

(A) $\frac{-13}{12}$

(B) $\frac{-11}{12}$

(C) $\frac{11}{12}$

(D) $\frac{13}{12}$

30. What is the domain of $y = \log_4 (x+2)$?

(A) $\{x | x > -2, x \in R\}$

(B) $\{x | x \geq -2, x \in R\}$

(C) $\{x | x > 2, x \in R\}$

(D) $\{x | x \geq 2, x \in R\}$

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

(A) $x = \log_y 6$

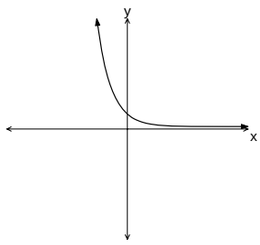
(B) $x = \log_6 y$

(C) $y = \log_x 6$

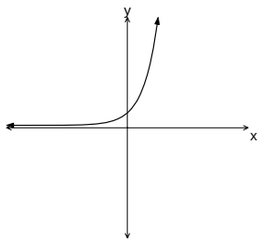
(D) $y = \log_6 x$

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

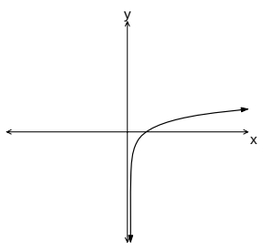
(A)



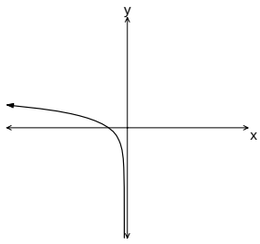
(B)



(C)



(D)



33. Which represents the transformation of $y = \log x$ after a horizontal translation of 2 units to the right and a vertical translation of 1 unit down?

(A) $y - 1 = \log(x - 2)$

(B) $y - 1 = \log(x + 2)$

(C) $y + 1 = \log(x - 2)$

(D) $y + 1 = \log(x + 2)$

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

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

35. What is the value of x if $2(3)^{\frac{x}{2}} = 24$?

(A) $\frac{\log 3}{2\log 12}$
(B) $\frac{\log 12}{2\log 3}$
(C) $\frac{2\log 3}{\log 12}$
(D) $\frac{2\log 12}{\log 3}$

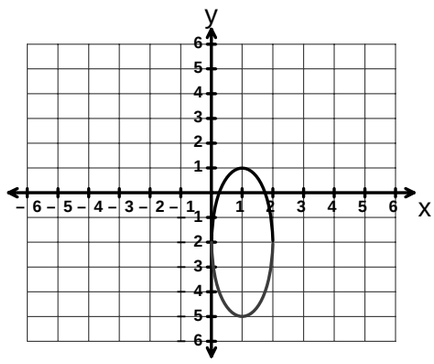
36. Solve: $2\log x - \log 4 = \log 5$.

(A) $\frac{\sqrt{5}}{2}$
(B) $\pm\frac{\sqrt{5}}{2}$
(C) $2\sqrt{5}$
(D) $\pm 2\sqrt{5}$

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

39. 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) $(-2,\frac{1}{2})$

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

(A) $\left[\frac{1}{4}(x-9)\right]^2 + \left[\frac{1}{4}y\right]^2 = 1$

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

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

(D) $\left[\frac{1}{4}(x-1)\right]^2 + \left[\frac{1}{4}(y-6)\right]^2 = 1$

41. What is the transformational form of the equation for the image of $x^2 + y^2 = 1$ under the mapping rule $(x, y) \rightarrow \left(\sqrt{7}\,x, \sqrt{7}\,y - 2\right)$?

(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 $(3, 0)$ on the terminal arm of angle θ is rotated $-120°$. What is the exact value of the image point?

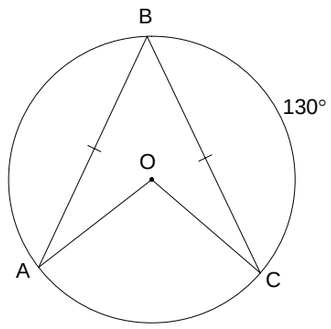
(A) $\left(-\frac{3\sqrt{3}}{2}, -\frac{3}{2}\right)$

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

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

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

43. In the circle with centre O shown, minor $\overset{\frown}{BC} = 130°$ and the diameter is 10 cm. What is the length, in cm, of minor $\overset{\frown}{AC}$?



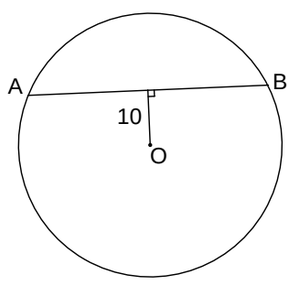
(A) $\frac{25}{18}\pi$

(B) $\frac{25}{9}\pi$

(C) $\frac{50}{9}\pi$

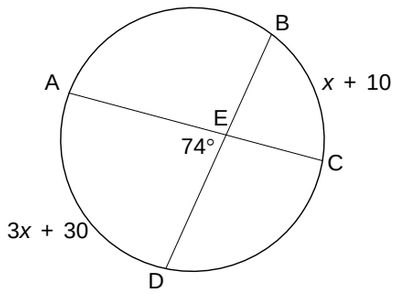
(D) $\frac{25}{360}\pi$

44. In the circle with centre O shown, the diameter is 52 cm. What is the length, in cm, of chord $\overline{AB}$ that is 10 cm from the centre?



(A) 24
(B) 48
(C) 51
(D) 102

45. In the circle shown $\angle AED = 74°$, minor $\overset{\frown}{AD} = (3x + 30)°$ and minor $\overset{\frown}{BC} = (x + 10)°$. What is the value of *x*?

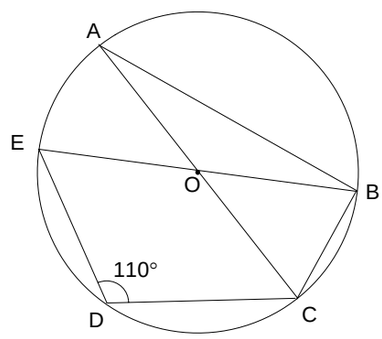


(A) $\frac{17}{2}$
(B) $\frac{44}{3}$
(C) 27
(D) 64

46. If the centre of an ellipse is $(-4, 6)$, the vertical axis is $2\sqrt{11}$, and the horizontal axis is 12, what is the equation of the ellipse?

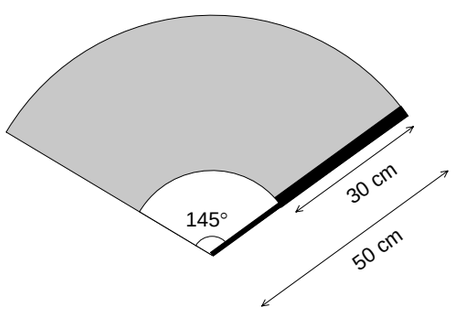
(A) $\left[\frac{1}{12}(x-4)\right]^2 + \left[\frac{1}{2\sqrt{11}}(y+6)\right]^2 = 1$
(B) $\left[\frac{1}{12}(x+4)\right]^2 + \left[\frac{1}{2\sqrt{11}}(y-6)\right]^2 = 1$
(C) $\left[\frac{1}{6}(x-4)\right]^2 + \left[\frac{1}{\sqrt{11}}(y+6)\right]^2 = 1$
(D) $\left[\frac{1}{6}(x+4)\right]^2 + \left[\frac{1}{\sqrt{11}}(y-6)\right]^2 = 1$

47. In the circle with centre O shown, $\angle EDC = 110°$. What is the value, in degrees, of $\angle BAC$?



(A) 20
(B) 35
(C) 45
(D) 55

48. The rear windshield wiper in a vehicle swings through an angle of 145° as shown. The blade portion of the wiper measures 30 cm and the entire length of the wiper measures 50 cm. As indicated by the shaded region, what area, in cm^2, is cleaned by the blade?

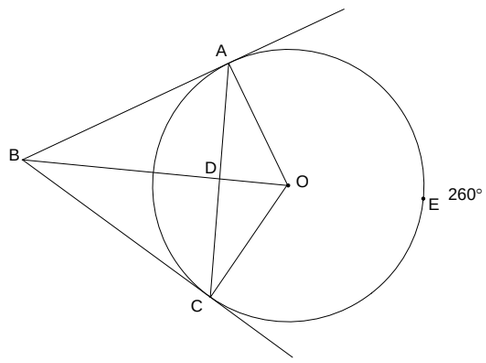


(A) 2025
(B) 2657
(C) 3037
(D) 3163

49. 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

50. In the circle with centre O shown, $\overline{AB}$ and $\overline{CB}$ are tangent to the circle and $\overset{\frown}{AEC} = 260°$. What is the measure, in degrees, of $\angle BAD$?



(A) 25
(B) 30
(C) 40
(D) 50

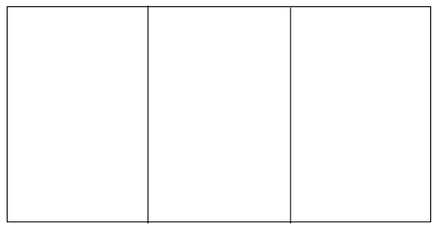
PART II
Total Value: 50%

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

Value

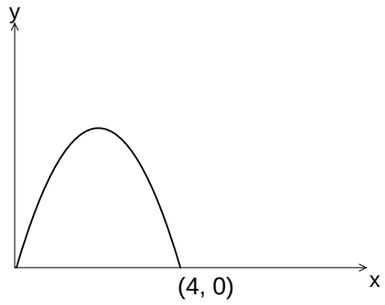
4 51. Algebraically determine the **exact** roots in simplest form for $x+\frac{4}{3}=\frac{-2}{x}$.

4 52. A farmer is constructing a rectangular pen for his animals, consisting of three sections as shown. If he has 100 m of fencing and wants to use it all, create a quadratic function that models the area of the pen, and use it to determine the maximum area of the pen.



Value

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.



4 54. A cannonball is shot into the air and its height *h*, in metres, after *t* seconds is recorded in the table below. Algebraically determine the quadratic function that models the height of the ball above the ground *t* seconds after it is shot into the air.

t	0	1	2	3	4
h	3	18.1	23.4	18.9	4.6

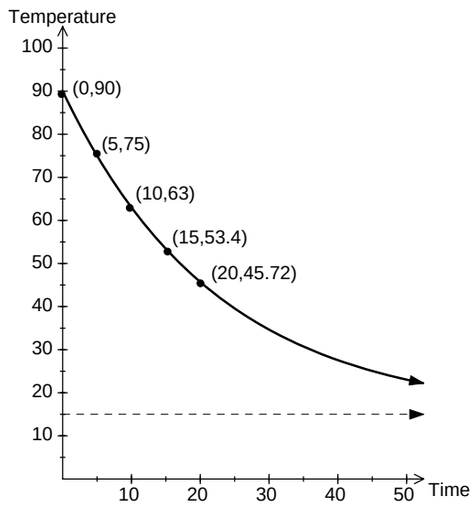
4 55. The motion of a ball thrown upward from the ground is described by $h(t) = -4.9t^2 + 11t$, where *h* is the height of the ball in metres and *t* is the time in seconds. Algebraically determine the approximate instantaneous rate of change in the height of the ball at 2 seconds, and describe how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

Value

4 56. Algebraically solve for x: $5\left(5^{2x}\right) + 7 = 36\left(5^{x}\right)$.

4 57. Algebraically solve for x: $\log_7 4 + \log_7 (x+3) = 2\log_7 x$.

4 58. A mug of hot chocolate is laid on a table to cool and its temperature, in degrees Celsius, over time, in minutes, is shown in the graph below. Algebraically determine the equation that models the temperature of the hot chocolate over time, and use it to determine the temperature of the hot chocolate after 30 minutes.



Value

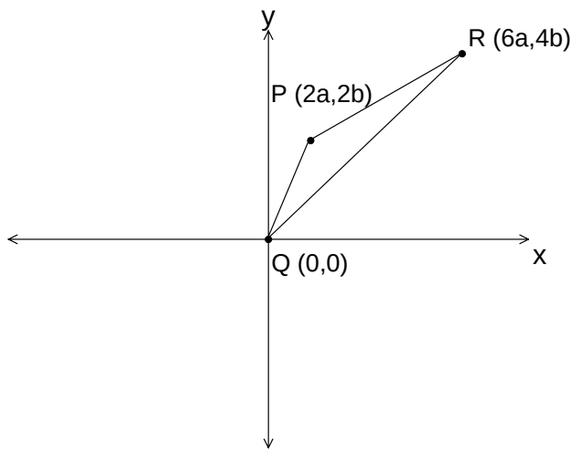
4 59. The amount of road salt in a storage shed decreases by 25% every 3 weeks. Write an equation that models this situation and use it to determine when $\frac{3}{5}$ of the original pile remains.

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 line segment that joins the centre $(-3, -5)$ of one circle, with the centre of another circle given by $x^2 + y^2 - 10x + 2y - 7 = 0$.

Value

4 62. Using coordinate geometry, prove that the segment joining the midpoints of sides $\overline{PQ}$ and $\overline{PR}$, is parallel to $\overline{QR}$.



4 63. In the circle with centre O shown, the diameter is 20 cm, ΔAOB is isosceles, and $\overline{AC} = 5$ cm. If $\overset{\frown}{CED} = 320°$ determine the area of the shaded region.