PART I
Total Value: 50%

Answer all items. Shade the letter of the correct answer on the computer scorable answer sheet. All items in Part I have a value of one point.

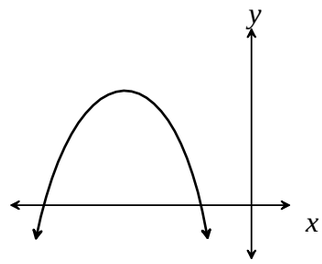
1. What equation is produced if $y = x^2$ is translated 4 units down, 3 units right, and vertically stretched by a factor of 10?

   (A) $\frac{1}{10}(y-4) = (x+3)^2$
   (B) $\frac{1}{10}(y+4) = (x-3)^2$
   (C) $10(y-4) = (x+3)^2$
   (D) $10(y+4) = (x-3)^2$

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

   (A) $\{y \mid y \le 2, y \in \mathrm{R}\}$
   (B) $\{y \mid y \ge 2, y \in \mathrm{R}\}$
   (C) $\{y \mid y \ge 3, y \in \mathrm{R}\}$
   (D) $\{y \mid y \in \mathrm{R}\}$

3. The graph of a quadratic function $f(x)$ is shown. What best describes the discriminant for $f(x) = 0$?



   (A) $\mathrm{D} < 0$
   (B) $\mathrm{D} = 0$
   (C) $\mathrm{D} \ge 0$
   (D) $\mathrm{D} > 0$

4. Which has the smallest vertical stretch factor compared to $y = x^2$?

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

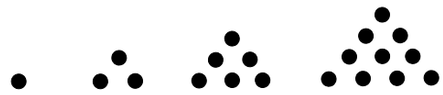
5. Which function has a maximum value of 1?

   (A) $-(y-1) = x^2$
   (B) $-y = (x-1)^2$
   (C) $(y-1) = x^2$
   (D) $y = (x-1)^2$

6. A quadratic function has a vertex of $(4,-5)$ and opens up. What is the nature of the roots?

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

7. What type of sequence is generated by the pattern shown?



(A) arithmetic

(B) cubic

(C) geometric

(D) quadratic

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

(A) $y=-2(x-1)^2-3$

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

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

(D) $y=2(x-1)^2-3$

9. What value of 'c' makes $x^2+3x+\mathrm{c}$ a perfect square?

(A) $\frac{9}{4}$

(B) $\frac{9}{2}$

(C) 9

(D) 36

10. What are the roots of $0=2x^2+36$?

(A) $\pm 3\sqrt{2}$

(B) $3\sqrt{2}$

(C) $\pm 3i\sqrt{2}$

(D) $3i\sqrt{2}$

11. Which represents a quadratic relationship?

(A)

x	1	2	3	4	5
y	13	21	29	37	45

(B)

x	2	3	4	5	6
y	4	6	12	22	36

(C)

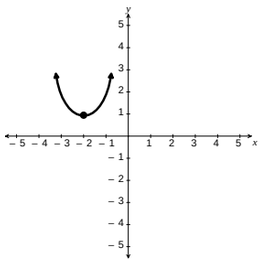
x	1	2	3	4	5
y	5	10	20	40	80

(D)

x	2	4	6	8	10
y	8	64	216	512	1000

12. The graph of $y = x^2$ is transformed using $(x, y) \to (x+2, -y-1)$. Which graph results?

(A)



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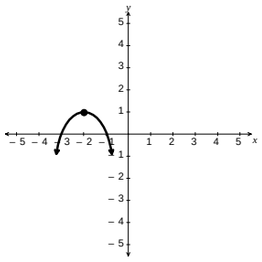

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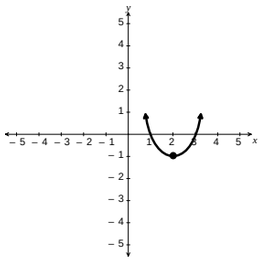
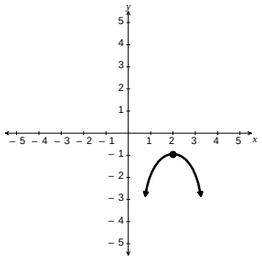


(D)



13. What are the zeros of $y = (x-3)(2x-5)$?

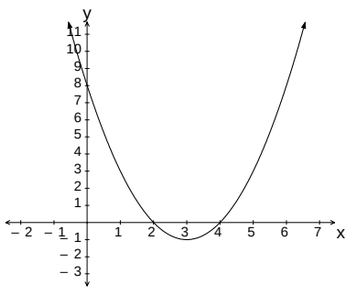
(A) $\left\{-3, -\frac{5}{2}\right\}$

(B) $\{0, 15\}$

(C) $\left\{\frac{5}{2}, 3\right\}$

(D) $\{3, 5\}$

14. What is the quadratic function for the graph shown?



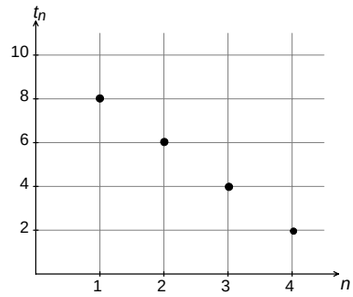
(A) $-(y-1) = (x+3)^2$

(B) $-(y+1) = (x-3)^2$

(C) $(y-1) = (x+3)^2$

(D) $(y+1) = (x-3)^2$

15. Which formula generates the sequence represented by the graph shown?



(A) $t_n = -2n + 10$

(B) $t_n = -n + 10$

(C) $t_n = -n + 8$

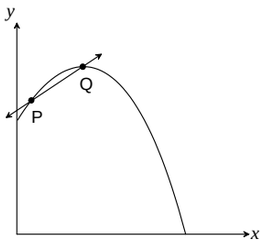
(D) $t_n = -2n + 8$

16. If $t_n = 2n^2 + 3n - 1$, what is the value of t_3?

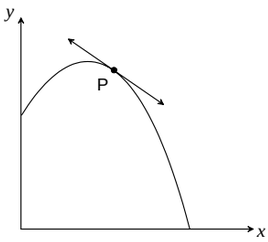
(A) 14
(B) 20
(C) 26
(D) 44

17. Which line best illustrates a negative instantaneous rate of change at P?

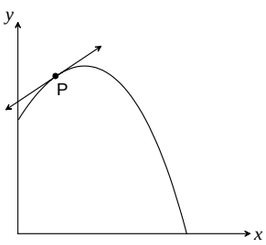
(A)



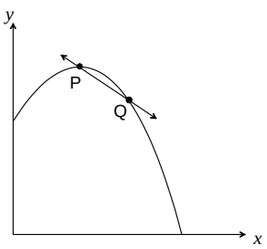
(B)



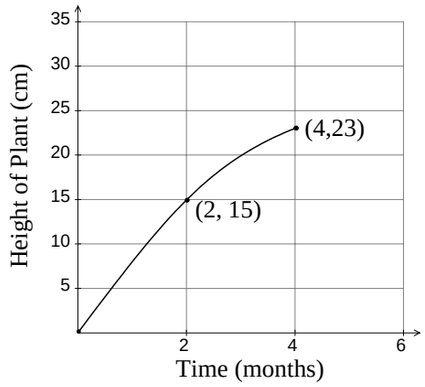
(C)



(D)



18. Suppose this diagram indicates the height of a plant (in centimeters) over several months. What is the average rate of change of the height of the plant between months 2 and 4 in cm per month?



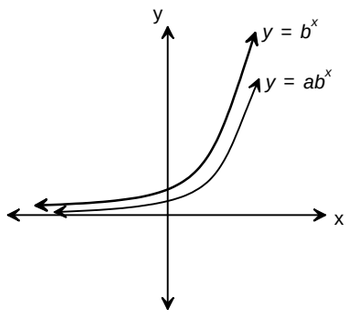
(A) $\frac{1}{4}$

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

(C) 4

(D) 8

19. The graphs of $y = b^x$ and $y = a \cdot b^x$ are shown. What value best represents a?



(A) -2

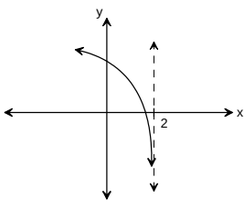
(B) $-\frac{1}{2}$

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

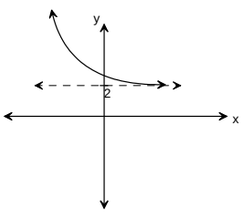
(D) 2

20. Which graph represents a decreasing exponential function with asymptote $y = 2$?

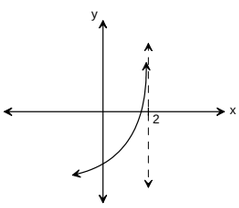
(A)



(B)



(C)



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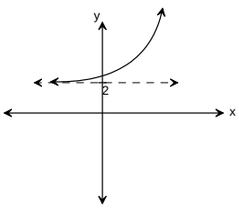
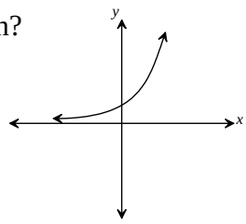
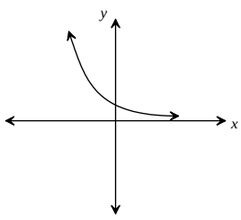


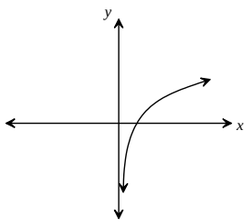
21. Which graph best represents the inverse of the function shown?



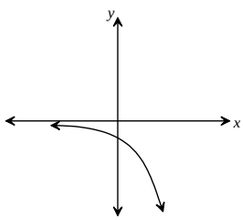
(A)



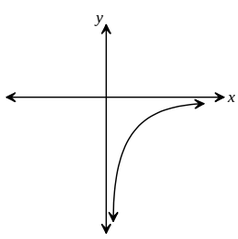
(B)



(C)



(D)



22. Which pattern below represents a geometric sequence?

(A) $\{2+3, 2+3+3, 2+3+3+3, \ldots\}$

(B) $\{2\times 4, 2\times 5, 2\times 6, \ldots\}$

(C) $\{2\times 3, 2\times 3^2, 2\times 3^3, \ldots\}$

(D) $\{2+3, 2+3^2, 2+3^3, \ldots\}$

23. What is the domain of $y = \log_3 x$?

(A) $\{x \mid x > 0, x \in \mathrm{R}\}$

(B) $\{x \mid x < 0, x \in \mathrm{R}\}$

(C) $\{x \mid x > 3, x \in \mathrm{R}\}$

(D) $\{x \mid x < 3, x \in \mathrm{R}\}$

24. What is the logarithmic form of $5^x = 6$?

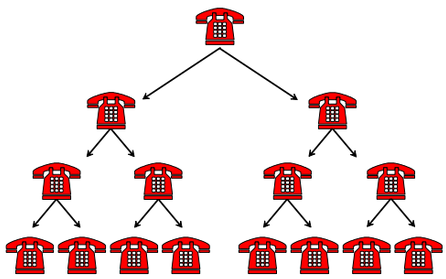
(A) $\log_5 x = 6$

(B) $\log_5 6 = x$

(C) $\log_6 x = 5$

(D) $\log_x 5 = 6$

25. What type of sequence is depicted by the phone tree shown?



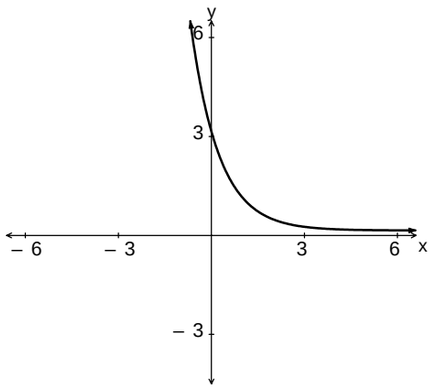
(A) cubic

(B) geometric

(C) quadratic

(D) quartic

26. Which equation best represents the graph shown?



(A) $y = \left(\frac{1}{3}\right)^x$

(B) $y = (3)^x$

(C) $y = 3\left(\frac{1}{3}\right)^x$

(D) $y = 3(3)^x$

27. Which expression is equivalent to $\left(\frac{1}{9}\right)^{2x-1}$?

(A) 3^{-4x-1}
(B) 3^{-4x+2}
(C) 3^{4x-1}
(D) 3^{4x-2}

28. Solve: $3\log_2 x = 12$

(A) 2
(B) 4
(C) 8
(D) 16

29. Evaluate: $\log_7 13$

(A) 0.76
(B) 1.19
(C) 1.32
(D) 1.86

30. Which situation would be best modeled by an exponential relationship?

(A) depth of water in a cylindrical tank as it is filled with 30L of water each minute
(B) height of a rock thrown in the air from the time it is thrown until it hits the ground
(C) height of the sun above the horizon over a 24 hour period
(D) value of a lawnmower that depreciates by 15% annually

31. Which function describes this data?

x	-3	0	3	6	9
y	$\frac{2}{3}$	$\frac{4}{3}$	$\frac{8}{3}$	$\frac{16}{3}$	$\frac{32}{3}$

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

32. Solve: $6^{-x+2} = 36^{x+4}$

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

33. Hector paid $ 20 000 for a new car. If it depreciates 5% every 6 months, which equation best models the value of the car in terms of the number of months since it was purchased?

(A) $V = 20\,000(0.05)^{\frac{m}{6}}$
(B) $V = 20\,000(1.05)^{6m}$
(C) $V = 20\,000(0.5)^{6m}$
(D) $V = 20\,000(0.95)^{\frac{m}{6}}$

34. Evaluate: $\left(7^0 - 4^{-1}\right)^{-3}$

(A) -125
(B) -64
(C) -63
(D) $\frac{64}{27}$

35. Write as a single logarithm: $2\log_6 3 + \log_6 4 - \log_6 8$.

(A) $\log_6 2$
(B) $\log_6 3$
(C) $\log_6 \frac{9}{2}$
(D) $\log_6 5$

36. The graph of which function is decreasing at a faster rate from $x = -4$ to $x = -1$?

(A) $y = \left(\frac{1}{3}\right)^x$

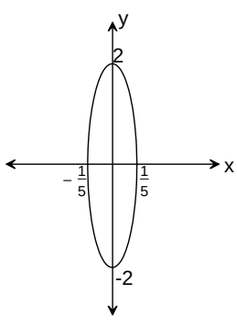
(B) $y = \left(\frac{1}{2}\right)^x$

(C) $y = 2^x$

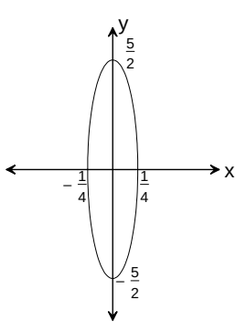
(D) $y = 3^x$

37. The graph of $x^2 + y^2 = 1$ is stretched horizontally by a factor of ½ and stretched vertically by a factor of 5 units. Which is the resulting graph?

(A)



(B)



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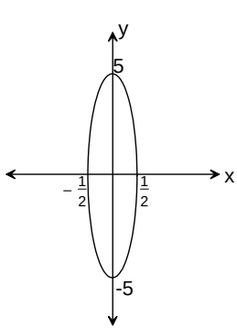

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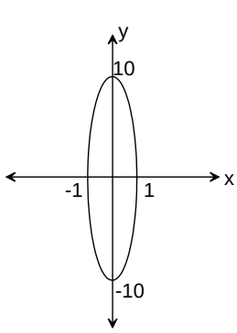
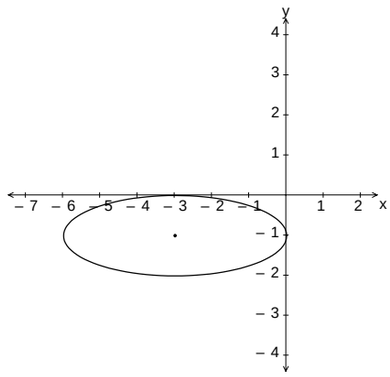


38. What is the converse of:

"*If two chords of a circle are parallel, then the two arcs between the chords are congruent*" ?

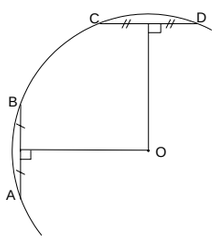
(A) If the two arcs between the chords in a circle are congruent, then the chords are not parallel.
(B) If the two arcs between the chords in a circle are not congruent, then the chords are not parallel.
(C) If the two arcs between the chords in a circle are congruent, then the chords are parallel.
(D) If two chords of a circle are not parallel, then the arcs between the chords are not congruent.

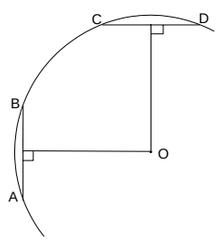
39. Which is the equation of the graph shown?

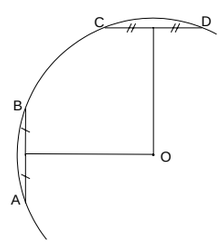


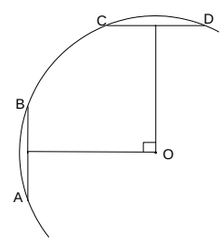
(A) $\left[\frac{1}{3}(x+3)\right]^2+(y+1)^2=1$
(B) $\left[\frac{1}{3}(x+3)\right]^2-(y+1)^2=1$
(C) $\left[(x+3)\right]^2+\left[\frac{1}{3}(y+1)\right]^2=1$
(D) $\left[3(x+3)\right]^2+(y+1)^2=1$

40. B and C are on $\overset{\frown}{AD}$. In which case must O be the center of the circle?

(A)


(B)


(C)


(D)


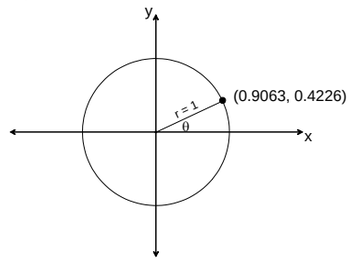
41. A point on the graph of $x^2 + y^2 = 25$ is rotated through an angle θ from standard position. What are the coordinates of the point?

(A) $(5\cos\theta, 5\sin\theta)$
(B) $(5\sin\theta, 5\cos\theta)$
(C) $(10\cos\theta, 10\sin\theta)$
(D) $(\cos\theta, \sin\theta)$

42. In a circle with radius 7 cm, a chord is 3 cm from the center. How long is another chord located 3 cm from the center?

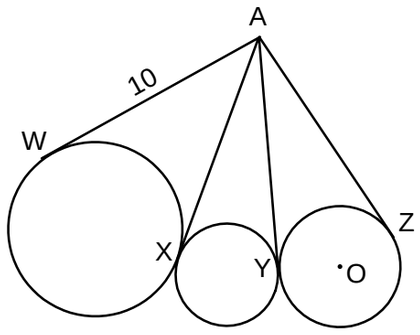
(A) $2\sqrt{10}$
(B) 7
(C) $4\sqrt{10}$
(D) 14

43. A circle with angle θ in standard position is shown. What would be the coordinates of the point, with the same related angle θ in the fourth quadrant, on a circle with radius 2?



(A) (–1.8126, 0.8452)
(B) (–0.9063, 4.226)
(C) (0.9063, – 0.4226)
(D) (1.8126, – 0.8452)

44. $\overline{AW}, \overline{AX}, \overline{AY}$ and $\overline{AZ}$ are tangents to the circle as shown. If $AO = 11$, what is the length of the diameter for the circle center O?

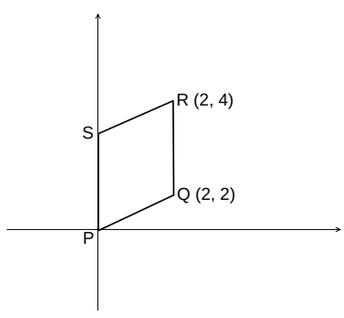


(A) 1
(B) 2
(C) $\sqrt{21}$
(D) $2\sqrt{21}$

45. What is the length of the major axis of $9x^2 + 4y^2 = 36$?

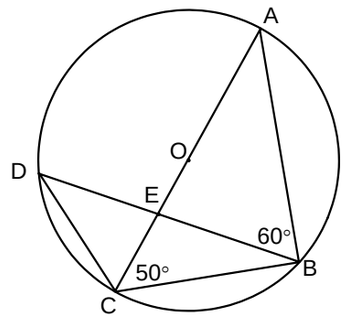
(A) 2
(B) 3
(C) 4.5
(D) 6

46. What is the distance between R and the midpoint of $\overline{PQ}$?



(A) 2
(B) $\sqrt{2}$
(C) $\sqrt{10}$
(D) 10

47. In the circle with center O, what is $m\angle DCE$?



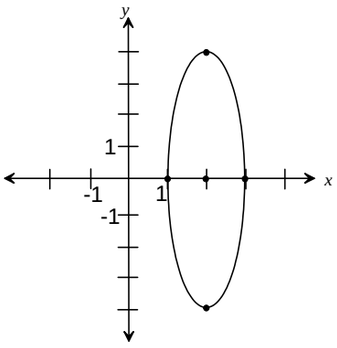
(A) 30°

(B) 40°

(C) 50°

(D) 60°

48. The graph of $x^2 + y^2 = 1$ is transformed to the graph shown. What is the mapping rule?



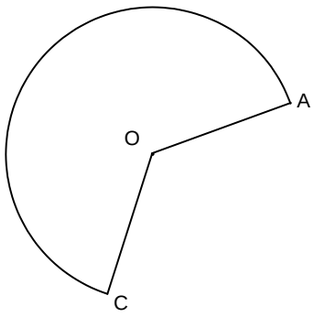
(A) $(x, y) \rightarrow (x - 2, \frac{1}{4}y)$

(B) $(x, y) \rightarrow (x - 2, 4y)$

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

(D) $(x, y) \rightarrow (x + 2, 4y)$

49. Sector AOC is cut from a circle and the remaining region shown is used to form a cone. If the radius of the cone is 5.0 cm and the height is 12.0 cm, what is the radius of the original circle in cm?



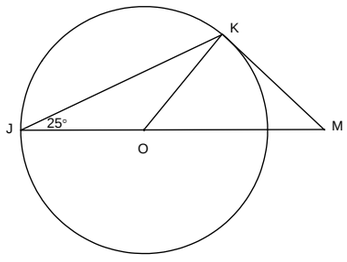
(A) 5.0

(B) 10.9

(C) 12.0

(D) 13.0

50. J and K are on the circle, $\overline{MK}$ is tangent to the circle and O is the center. What is $m\angle M$?



(A) 25°

(B) 40°

(C) 50°

(D) 65°

PART II
Total Value: 50%

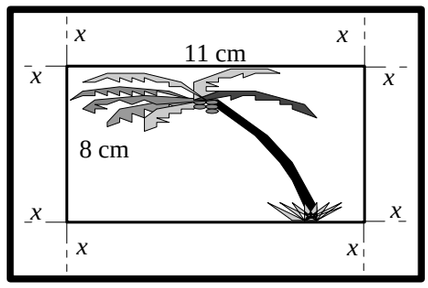
Answer **ALL** items in the space provided. Show **ALL** workings.

Value

4 51. Algebraically determine the EXACT roots in simplest form for $x(x-2)=-3$.

4 52. A cannonball is fired from a cannon and its height, h, in metres above the ground, t seconds after being fired, is given by $h(t)=-5t^2+40t+3$. Algebraically determine the maximum height attained by the cannonball and the time taken to reach this height.

4 53. A photograph 8 cm by 11 cm will be framed as shown in the diagram. The combined area of the frame and photograph will be 180 cm^2. Algebraically determine the outside dimensions of the frame.



4 54. A diver jumps off a spring board. Her height *h*, in metres above the water, *t* seconds after she jumps, is given by $h(t) = -4.9t^2 + 8t + 5$. Algebraically determine the approximate instantaneous rate of change in her height at 2 seconds.

3 55. Solve for x: $3^{5x-1} = \sqrt[3]{9}$.

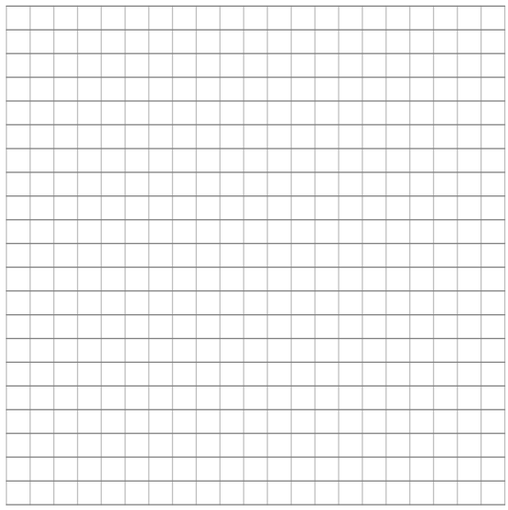
4 56. Solve for x: $\log_2(5x-2) - \log_2 2 = \frac{1}{2}\log_2 36 + 2\log_2 3$.

4 57. An element has a half-life of 120 years. If its initial mass is 42 grams, algebraically determine how long it will take to decrease to 5 grams.

4 58. Hot chocolate cools exponentially over time after it is brought into a stadium and the cooling is described by the function given with temperature, *T*, in degrees Celsius and time, *m*, in minutes.

$$T = 45(0.95)^m + 5$$

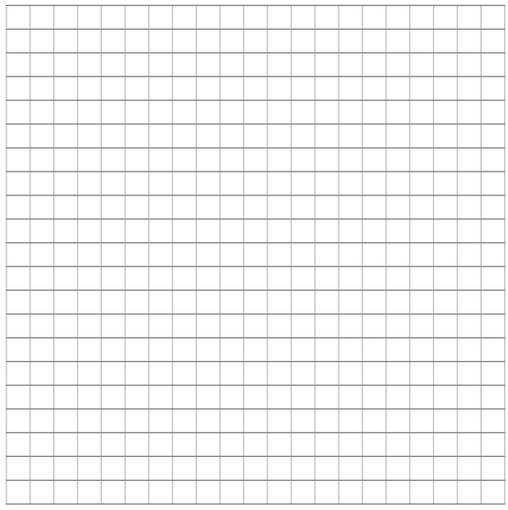
Sketch a labeled graph for the first 100 minutes. State the initial temperature of the hot chocolate and the air temperature in the stadium.



3 59. Write the equation of the circle, in standard form, with center $(-2,3)$ and passing through the point $(4,-5)$.

4 60. Write $9x^2 + y^2 + 18x - 6y + 9 = 0$ in transformational form.

4 61. A rectangle has vertices A(8, 0), B(2, –9), C(–1, –7), and D(5, 2). Sketch the rectangle and find its area.



4 62. $\overline{AB}$ is a chord of a circle with radius 10 cm. If $m\overset{\frown}{AB}$ is $72°$, find the area of the region enclosed by $\overline{AB}$ and $\overset{\frown}{AB}$.

4 63. Point $P(6,7)$ lies on the circle, with centre $(-2,1)$, as shown. Determine the equation of the tangent line to the circle at P.