

PART I
Total Value: 50%

Shade in the letter of the correct response on the computer scorable answer sheet.

1. What is the common difference for the function $t_n = \frac{3}{5}n + 1$?

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

2. The data in the table models the path of an accelerating car. What type of function would best model this data?

Time (seconds)	Distance (metres)
0	0.0
1	21.4
2	45.6
3	72.6
4	102.4
5	135.0

- A) cubic
 - B) exponential
 - C) linear
 - D) quadratic
3. What is the nature of the roots for a quadratic function having a discriminant equal to 0?
- A) two equal real (double real root)
 - B) two unequal real
 - C) two unequal imaginary
 - D) two equal imaginary (double imaginary root)
4. Which is a function that crosses the x -axis at -1 and 2?
- A) $y = (x - 1)(x - 2)$
 - B) $y = (x + 1)(x - 2)$
 - C) $y = (x - 1)(x + 2)$
 - D) $y = (x + 1)(x + 2)$

5. What are the roots of $x^2 + 25 = 0$?

- A) 5
- B) $5i$
- C) ± 5
- D) $\pm 5i$

6. A quadratic equation was solved by completing the square, as shown below. Which step contains a mathematical error?

Equation: $-x^2 - 12x + 64 = 0$

Solution: Step 1 → $-(x^2 + 12x) = -64$
Step 2 → $-(x^2 + 12x + 36) = -100$
Step 3 → $(x + 6)^2 = 100$
Step 4 → $x = 4$

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

7. What is the transformational form of the function $y = \frac{1}{3}(x - 2)^2 + 4$?

- A) $y = \frac{1}{3}x^2 - \frac{4}{3}x + \frac{16}{3}$
- B) $\frac{1}{3}(y - 4) = (x - 2)^2$
- C) $3(y - 4) = (x - 2)^2$
- D) $3(y - 12) = (x - 2)^2$

8. What is the value of the discriminant for the equation $2x^2 - 9x - 6 = 0$?

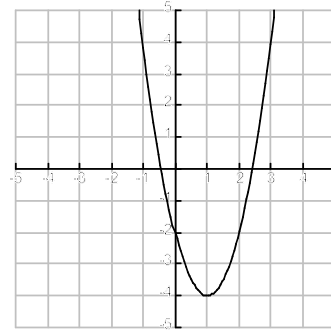
- A) $\sqrt{33}$
- B) $\sqrt{129}$
- C) 33
- D) 129

9. Which function describes the sequence $\{-2, -6, -10, -14, -18, \dots\}$?

- A) $t_n = 2 - 4n$
- B) $t_n = -6 + 4n$
- C) $t_n = -6 - 4n$
- D) $t_n = -3 - 4n$

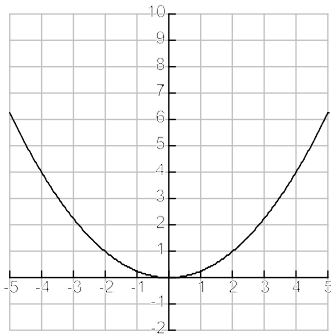
10. Which function represents the given graph?

- A) $y = -2(x - 1)^2 - 4$
- B) $y = -2(x + 1)^2 + 4$
- C) $y = 2(x - 1)^2 - 4$
- D) $y = 2(x + 1)^2 + 4$

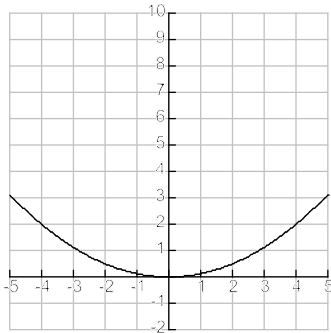


11. Which graph has a vertical stretch factor of $\frac{1}{2}$ when compared to the graph of $y = x^2$?

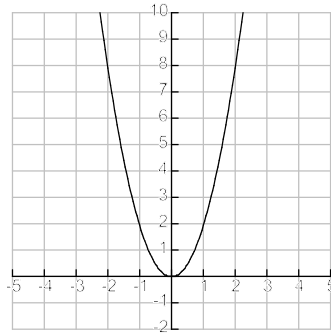
A)



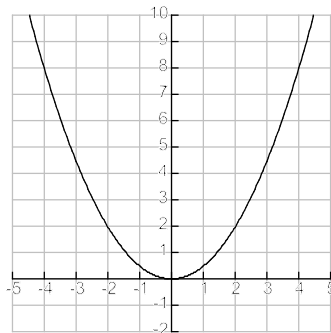
B)



C)



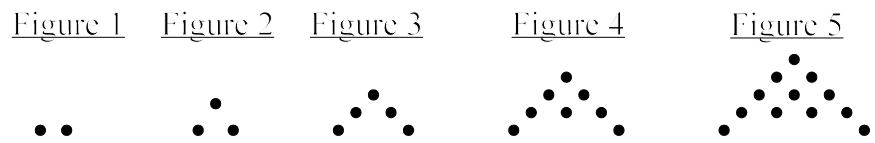
D)



12. What are the coordinates of the vertex for the quadratic function having a maximum value of 20 and x -intercepts located at $(5, 0)$ and $(-1, 0)$?

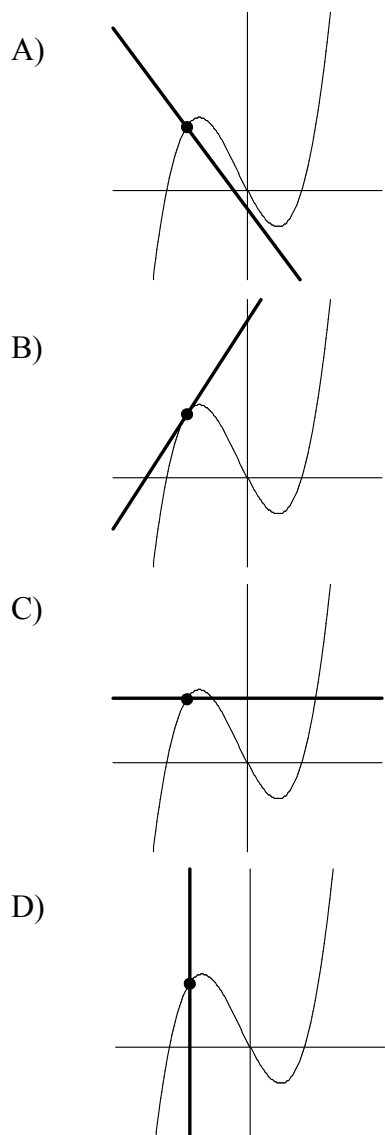
- A) $(0, 20)$
- B) $(2, 0)$
- C) $(2, 20)$
- D) $(20, 0)$

13. What type of graph would represent the sequence shown by the dot patterns, where the Figure Number is the independent variable and the Number of Dots is the dependent variable?



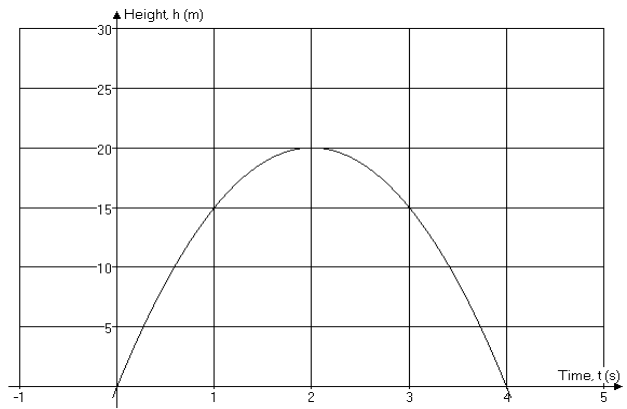
- A) continuous linear
- B) continuous quadratic
- C) discrete linear
- D) discrete quadratic

14. Which line has a slope that would best represent the instantaneous rate of change of the curve at the indicated point?



15. The path of a rock thrown vertically upward is shown by the graph. What is the average velocity of the rock (in m/s) between $t = 2.0$ s and $t = 3.0$ s?

- A) -5
 B) 7
 C) 5
 D) -7



16. Which function produces a growth curve?

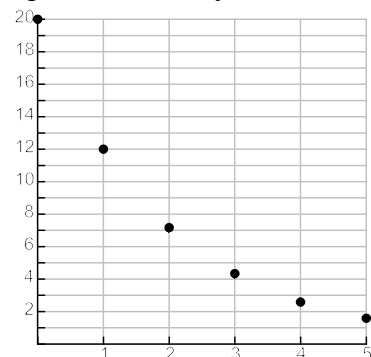
- A) $y = \left(\frac{1}{2}\right)^x$
 B) $y = \left(\frac{3}{2}\right)^{-x}$
 C) $y = (0.4)^x$
 D) $y = (1.1)^x$

17. Which function has domain $\{x \mid x \in \mathbb{R}\}$ and range $\{y \mid y > -3, y \in \mathbb{R}\}$?

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

18. A regression was performed on a graphing calculator for the data graphed below. Four people copied the function from the calculator, but only one person copied it correctly. Who was correct?

- A) Amy: $y = 20(0.6)^x$
 B) Barney: $y = 20(0.6x)$
 C) Casper: $y = 20(0.6)^{-x}$
 D) Dudley: $y = 20(6)^x$



19. What is the inverse of the function $y = 3^x$?

- A) $y = \log_3 x$
 B) $y = \log_x 3$
 C) $y = \left(\frac{1}{3}\right)^x$
 D) $y = 3^{-x}$

20. At which point would the line $y = 4$ and the exponential function $y = 3(2^x) + 1$ intersect?
- A) $(-1, 4)$
 B) $(0, 4)$
 C) $(1, 4)$
 D) $(2, 4)$

21. Which function describes the data in the table?

x	0	3	6	9	12
y	10	20	40	80	160

- A) $y = 10(2)^{x/3}$
 B) $y = 10(2)^{3x}$
 C) $\frac{1}{3}y = 10(2)^x$
 D) $3y = 10(2)^x$
22. What is the simplified form of $\frac{b \cdot b^n}{(b^3)^n}$?
- A) $\frac{1}{b^n}$
 B) $\frac{1}{b^2}$
 C) b^{1-2n}
 D) b^n
23. Express $2 \log B - \log C + \log D$ as a single logarithm.

- A) $2 \log \frac{BD}{C}$
 B) $\log \frac{B^2 D}{C}$
 C) $\log \frac{2BD}{C}$
 D) $2 \log(BD - C)$

24. Roy used the following steps to solve the equation $\log_x 9 = \frac{3}{2}$. Which step contains a mathematical error?

Step 1 → $x^{3/2} = 9$

Step 2 → $x = 9^{3/2}$

Step 3 → $x = (\sqrt{9})^3$

Step 4 → $x = 27$

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

25. Solve for x : $3^x = 5$

- A) -0.22
B) 0.22
C) 0.68
D) 1.46

26. What are the coordinates of the y -intercept of the graph of $y = -2(4)^x + 5$?

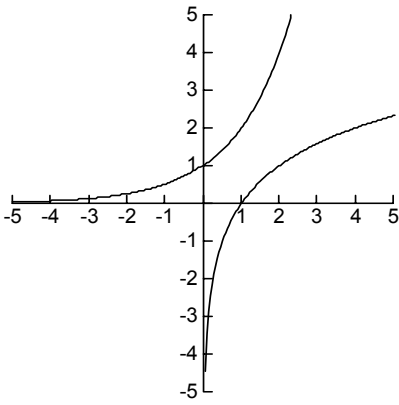
- A) (0, -2)
B) (0, 3)
C) (0, 4)
D) (0, 5)

27. Solve for x : $4^x = 32$

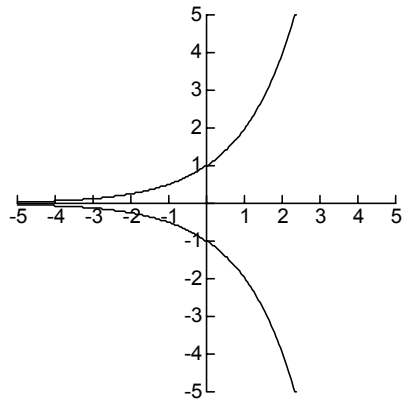
- A) 0.4
B) 2.5
C) 8
D) 10

28. Which of the following pairs of graphs are inverses of each other?

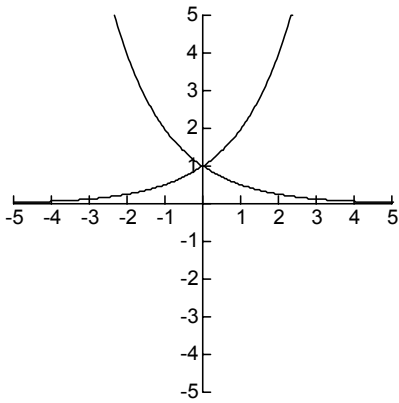
1.



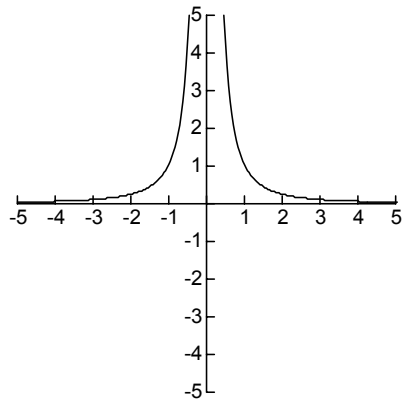
2.



3.



4.



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

29. What is the exponential form of $\log_b a = c$?

- A) $b^a = c$
- B) $c = a^b$
- C) $b^c = a$
- D) $a = c^b$

30. John invested \$10000 at 8% annual interest. If A is the amount of money in dollars at time T , which function correctly models the growth of his money?

- A) $A = 10000(0.08)^T$
- B) $T = 10000(1.08)^A$
- C) $A = 10000(1.08)^T$
- D) $A = 10000(0.92)^T$

31. Which equation would represent a stretch of the unit circle by a factor of 2 horizontally and vertically, and a translation of 2 units left and 3 units up?

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

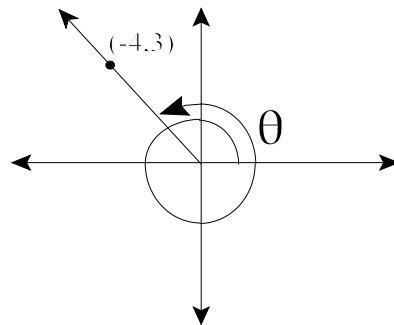
32. What is the converse of this statement?

If two chords are equidistant from the centre of a circle, then the chords are congruent.

- A) If two chords are equidistant from the centre of a circle, then they are parallel
 B) Two chords the same distance from the centre of a circle are congruent.
 C) If two chords of a circle are congruent, then they are equidistant from the centre of the circle.
 D) If two chords pass through the centre of a circle, then they are congruent.

33. What is the cosine of θ ?

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



34. What is the length of the major axis of $\frac{x^2}{16} + \frac{y^2}{9} = 1$?

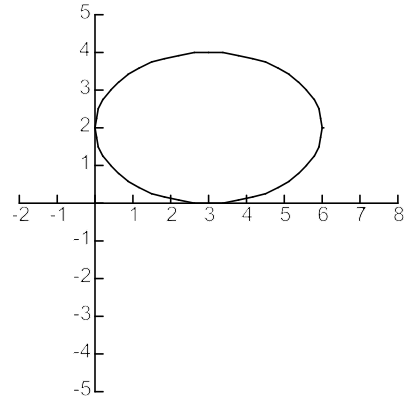
- A) 3
 B) 4
 C) 6
 D) 8

35. Which is standard form for $(x-3)^2 + (y+1)^2 = 1$?

- A) $x^2 + y^2 - 6x + 2y - 7 = 0$
 B) $x^2 + y^2 - 6x + 2y + 9 = 0$
 C) $x^2 + y^2 + 6x - 2y + 9 = 0$
 D) $x^2 + y^2 + 6x + 2y - 7 = 0$

36. Which equation best describes the graph?

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



37. What is the EXACT value of $\sin 225^\circ + \cos 225^\circ$?

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

38. What is the simplest form of $2 \sin^2 \theta + \cos^2 \theta$?

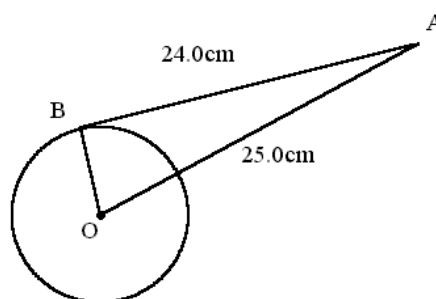
- A) 1
- B) 2
- C) $\sin^2 \theta + 1$
- D) $2 \sin^2 \theta$

39. Given \overline{AB} with midpoint $M(2, -3)$ and endpoint $B(-5, 1)$, what are the coordinates of A ?

- A) $(-9, -7)$
- B) $(-9, 7)$
- C) $(-7, 9)$
- D) $(9, -7)$

40. The circle in the diagram has centre O . AB is tangent to the circle at B . What is the diameter of the circle?

- A) 7.0 cm
- B) 14.0 cm
- C) 34.7 cm
- D) 69.4 cm

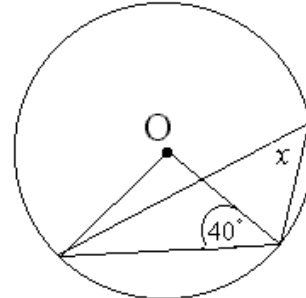


41. Dave's cabin is located at the point (3, 5) on a coordinate grid map. Pat's cabin is located at (10, 15). What is the exact distance between their cabins?

- A) $\sqrt{29}$
- B) $\sqrt{51}$
- C) $\sqrt{149}$
- D) 13

42. The circle has centre at O. What is the value of x ?

- A) 20
- B) 40
- C) 50
- D) 100



43. If the equation of a circle is $x^2 + y^2 + 3x - my + 10 = 0$, and the point (2, -5) lies on the circle, what is the value of m ?

- A) -9
- B) -2
- C) $\frac{33}{5}$
- D) 9

44. Which is an example of a combination?

- A) The number of ways to arrange five different pictures on a wall
- B) The number of ways to seat the five flute players in the front row of an orchestra
- C) The number of ways to select 6 people to do an oral report from 20 students
- D) The number of ways to arrange Volumes 1 to 8 of an encyclopedia set on a shelf.

45. On Survivor Island, a license plate consists of three characters. The first is a digit from 0 to 9, the second is an A or an E, and the third is a different digit from 0 to 9. How many different license plates are possible if no characters can be repeated?

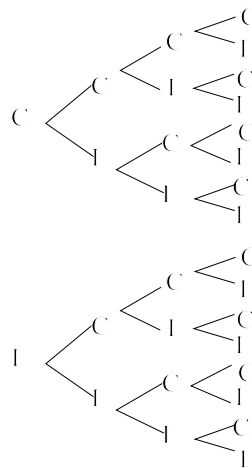
- A) 144
- B) 162
- C) 180
- D) 200

46. Three students are selected from a Math Club of twenty students to be the president, the vice president, and the treasurer. How many ways can this group be selected?

- A) $\frac{20!}{3!17!}$
 B) $\frac{17!}{20!}$
 C) $\frac{20!}{17!}$
 D) $\frac{20!}{3!}$

47. Marilyn takes a four question true-false test on a subject she knows nothing about, so she guesses. What is her probability of passing if she needs to obtain a score of at least 75%?

- A) $\frac{1}{16}$
 B) $\frac{4}{16}$
 C) $\frac{5}{16}$
 D) $\frac{1}{2}$



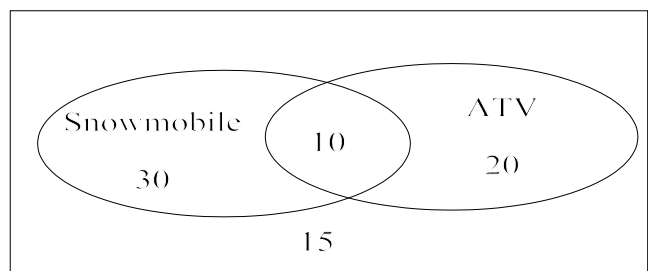
Note: I = Incorrect Response
 C = Correct Response

48. If events A and B are mutually exclusive, which of the following statements are TRUE ?

- A) $P(A \text{ and } B) = P(A) + P(B) - P(A \text{ or } B)$
 B) $P(A \text{ or } B) = P(A) + P(B)$
 C) $P(A \text{ and } B) = P(\bar{A}) + P(\bar{B})$
 D) $P(A \text{ or } B) = P(A) - P(B)$

49. 75 people in a survey were asked, “Do you own a snowmobile or an ATV?” The results are shown in the diagram. What is the probability that a person owns an ATV?

- A) $\frac{4}{15}$
 B) $\frac{1}{3}$
 C) $\frac{2}{5}$
 D) $\frac{1}{2}$



50. At a chain of fast food restaurants, 6 of the 10 different available entrés each have more than 20g of fat. If three different entrés are selected at random, approximately what is the probability that the first three selected will each have more than 20g of fat?

- A) 0.180
 B) 0.167
 C) 0.216
 D) 0.300

PART II
Total Value: 50%

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

Value

4%

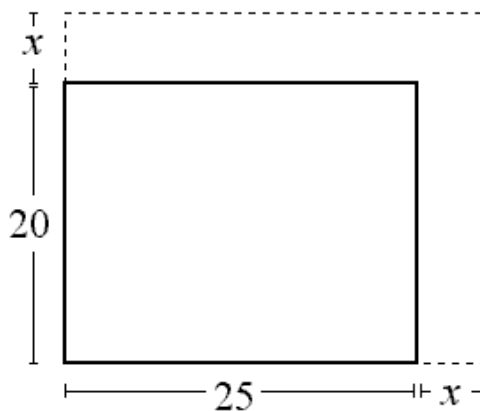
51. Find algebraically the EXACT roots in simplest form: $4x^2 = 4x + 1$.

4%

52. A cannonball, fired from ground level, reaches a maximum height of 50m when it is fired at a ground-level target which it hits 100m away. How high is the cannonball above the ground when it is 20m from the target?

4%

53. A rectangular rink having dimensions 25m by 20m is to be expanded by adding rectangular strips of equal width as shown. If the new rink will have an area of 644m^2 , what will be the width of the strip?



Value

3%

54. The height of an arrow shot into the air is described by the function $h(t) = -5t^2 + 37t + 1.55$, where h is the height in metres and t is the time in seconds. Find the approximate instantaneous rate of change at 3.7 seconds and describe what is happening to the arrow at this point.

3%

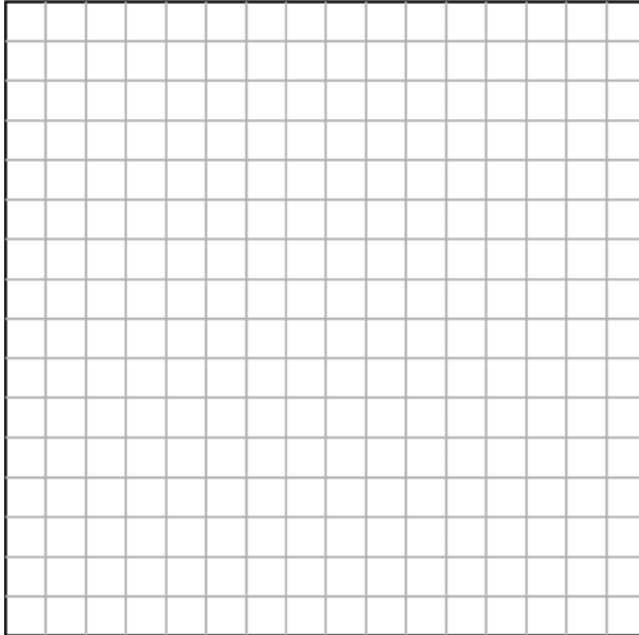
55. Solve for x : $\log_5(10x + 4) - \log_5 2 = \frac{1}{2} \log_5 49 + 2 \log_5 4$

4%

56. Solve for x : $4^{2x+3} = \left(\sqrt[4]{2}\right)^x$

Value

- 4% 57. The temperature of a hot cup of coffee when served to a customer at *Dave's Slops & Donut Shop* is 90°C . The room temperature is 22°C and the temperature decreases at a rate of 7% each minute. Thoroughly explain, including a sketch of the graph, why this situation can be modeled by the function $T = 68(0.93)^m + 22$, where m is the number of minutes and T is the temperature in degrees Celsius.



- 4% 58. Chris wants to enlarge a diagram for her math class on a computer. She decides to try enlarging the diagram a number of times, by the same set percentage each time, until the diagram is large enough. The table shows the area of the diagram after each enlargement.

Number of Enlargements	0	1	2	3	4	5
Area (cm²)	40.0000	48.0000	57.6000	69.1200	82.9440	99.5328

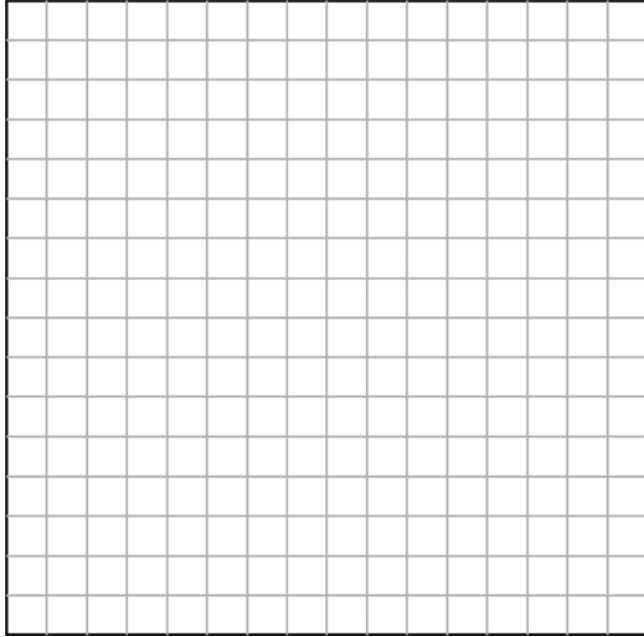
Find the exponential function which models this data, including statements to define the meaning of each variable. State the domain and range.

Value

- 4% 59. Prove that the triangle with vertices $X(3, 4)$, $Y(4, -1)$ and $Z(-1, -2)$ is an isosceles triangle.
- 3% 60. Pat is creating a new circular logo on his computer screen. The endpoints of the diameter are located at $(-3, 4)$ and $(5, 10)$. What is the equation, in standard form, of his new logo?
- 3% 61. A circular disk, centre $(0, 0)$ and having radius 8 units, rotates counter-clockwise at a rate of 14.125 revolutions per minute. A dot on the disk is initially located at $(8, 0)$. What would be the final coordinates, in exact form, of that dot if the disk starts rotating, rotates for precisely three minutes, and stops instantly.

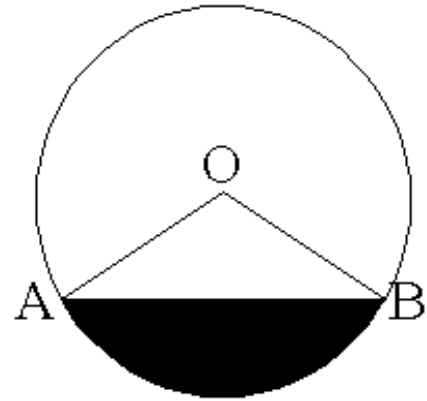
Value
3%

62. Determine the centre and lengths of the two axes of the ellipse given by:
 $9x^2 + 25y^2 - 36x - 50y - 164 = 0$ and sketch its graph on the grid below.



4%

63. The circle shown has centre at O, $\widehat{AOB} = 120^\circ$, and radius 25.0cm. If $AB = 43.4$ cm, what is the area of the shaded segment?



3%

64. There are 10 multiple choice questions on an exam, with each question having 4 possible answers. Chris is planning to guess at each question because he did not study as he should have. He needs to get at least 5 correct answers in order to pass. Design a simulation, stating any underlying assumptions and defining what is meant by one trial, to determine the probability that he will pass.