PART I
Total Value: 50%

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

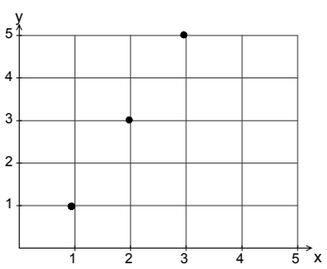
1. Which will produce the same graph as $-2(y-3)=(x+5)^2$?

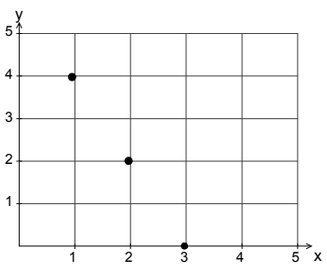
   (A) $y=-2(x+5)^2-3$
   (B) $y=-2(x+5)^2+3$
   (C) $y=-\frac{1}{2}(x+5)^2-3$
   (D) $y=-\frac{1}{2}(x+5)^2+3$

2. Which function represents the transformation of $y=x^2$ under the mapping rule $(x,y)\rightarrow(x-3,-\frac{1}{3}y+4)$?

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

3. Which represents a sequence with a first level difference of $-\frac{1}{2}$?

   (A)
   

   (B)
   

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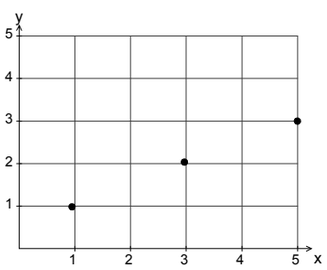
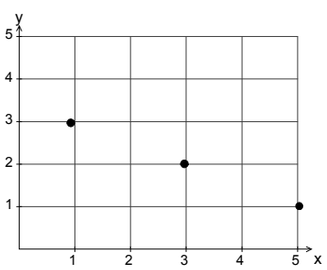
   

   (D)
   

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

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

5. What is the range of the function $y = 3(x-4)^2 + 5$?

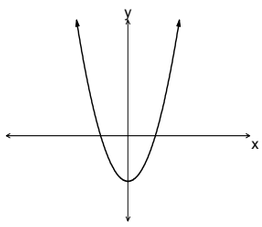
(A) $\{y \mid y \leq -5, y \in R\}$
(B) $\{y \mid y \leq 5, y \in R\}$
(C) $\{y \mid y \geq -5, y \in R\}$
(D) $\{y \mid y \geq 5, y \in R\}$

6. What is the axis of symmetry for the quadratic function $y - 4 = (x+2)^2$?

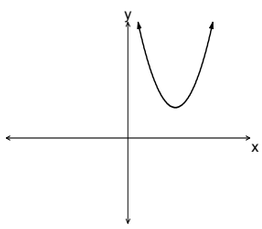
(A) $x = -4$
(B) $x = -2$
(C) $x = 2$
(D) $x = 4$

7. Which is the graph of a quadratic function with a negative leading coefficient and a negative discriminant?

(A)



(B)



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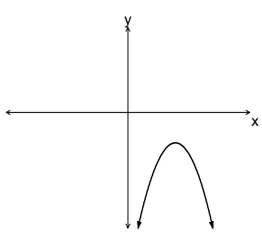

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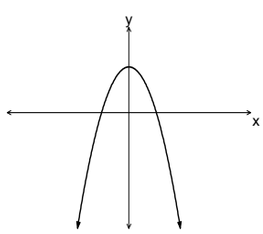


8. What is true of the roots of a quadratic function $ax^2 + bx + c = 0$ if $b^2 - 4ac > 0$?

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

9. What is the simplest form of $\frac{3 \pm \sqrt{-54}}{3}$?

(A) $\pm i\sqrt{6}$
(B) $\pm 3i\sqrt{6}$
(C) $1 \pm i\sqrt{6}$
(D) $1 \pm 3i\sqrt{6}$

10. What is the transformational form of $y = 4x^2 + 8x$?

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

11. What is t_n for the sequence $\left\{\frac{14}{3}, \frac{16}{3}, 6, \frac{20}{3}, \frac{22}{3}\right\}$?

(A) $t_n = \frac{2}{3}n + \frac{11}{3}$
(B) $t_n = \frac{2}{3}n + 4$
(C) $t_n = \frac{2}{3}n + \frac{14}{3}$
(D) $t_n = \frac{2}{3}n + 6$

12. Which represents a quadratic relationship?

(A)

x	1	2	3	4
y	–3	–5	–8	–13

(B)

x	1	2	3	4
y	–2	0	2	4

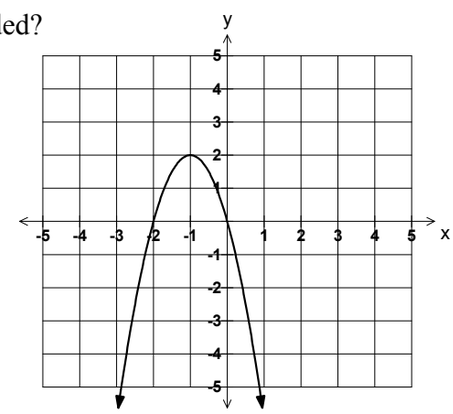
(C)

x	1	2	3	4
y	0.25	0.5	1	2

(D)

x	1	2	3	4
y	10	4	2	4

13. Which equation describes the graph provided?

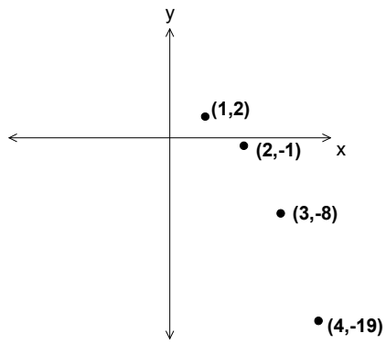


(A) $-2(y-2) = (x+1)^2$
(B) $-2(y+2) = (x+1)^2$
(C) $-\frac{1}{2}(y-2) = (x+1)^2$
(D) $-\frac{1}{2}(y+2) = (x+1)^2$

14. What value of "c" makes $x^2 + 14x + c$ a perfect square?

(A) $\frac{7}{2}$
(B) $\frac{49}{4}$
(C) 49
(D) 196

15. What is the value of D_2 for the sequence represented by the graph provided?



(A) -4
(B) -2
(C) 2
(D) 4

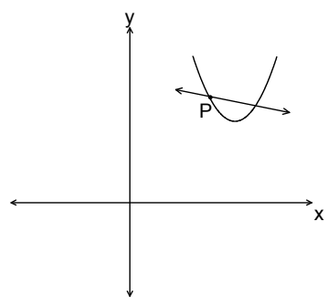
16. What are the roots for the function $2x^2 + 2 = 0$?

(A) $-1, -2$
(B) $-1, 1$
(C) $-i, i$
(D) $i, -2$

17. A lifeguard has 100 m of rope to enclose a rectangular swimming area. Which equation represents the maximum area of the enclosure if the lifeguard uses the beach as one side and the rope for the other three sides?

(A) $A = w(50 - w)$
(B) $A = w(50 - 2w)$
(C) $A = w(100 - w)$
(D) $A = w(100 - 2w)$

18. What rate of change is represented by the graph provided?



(A) negative average
(B) negative instantaneous
(C) positive average
(D) positive instantaneous

19. A student invests \$100 at 10% interest compounded annually. Using the data below, what is the average rate of change in the value of the investment between year 4 and year 8?

Year	0	2	4	6	8
Value	100	121	146.41	177.16	214.36

(A) 16.99
(B) 33.98
(C) 67.95
(D) 90.19

20. Which represents an exponential relationship?

(A)

x	1	2	3	4
y	3	–1	$-\frac{1}{3}$	$\frac{1}{9}$

(B)

x	1	2	3	4
y	3	0	–3	–6

(C)

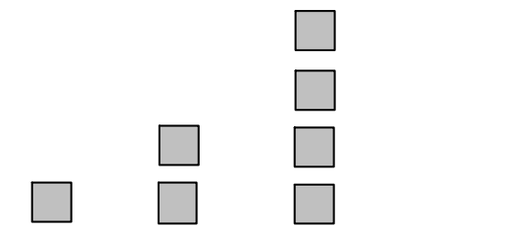
x	1	2	3	4
y	3	1	$\frac{1}{3}$	$\frac{1}{9}$

(D)

x	1	2	3	4
y	3	12	27	48

21. How many blocks are required in figure 4 to make a geometric sequence?

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



22. Evaluate $\left(3^0 + \frac{1}{4}\right)^{-2}$.

(A) $\frac{1}{16}$
(B) $\frac{16}{25}$
(C) $\frac{25}{16}$
(D) $\frac{16}{1}$

23. Which is equivalent to $\left(\frac{1}{81}\right)^{x+3}$?

(A) 3^{-4x-12}
(B) 3^{-4x-3}
(C) 3^{-4x+3}
(D) 3^{-4x+12}

24. Which function describes the data provided?

x	-4	0	4	8
y	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{24}$

(A) $y = \frac{1}{6}\left(\frac{1}{2}\right)^{\frac{x}{4}}$
(B) $y = \frac{1}{6}(2)^{\frac{x}{4}}$
(C) $y = \frac{1}{3}\left(\frac{1}{2}\right)^{\frac{x}{4}}$
(D) $y = \frac{1}{3}(2)^{\frac{x}{4}}$

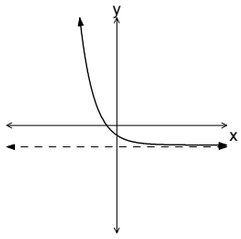
25. Solve $4^x = \sqrt{8^6}$.

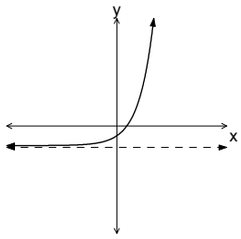
(A) $\frac{1}{2}$
(B) 3
(C) $\frac{9}{2}$
(D) 9

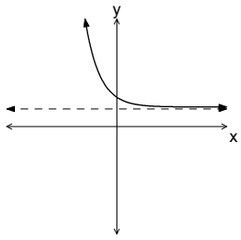
26. Solve: $25^{x+1} = 5^{4x-3}$.

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

27. Which represents $y = \left(\frac{1}{2}\right)^x - 2$?

(A)


(B)


(C)


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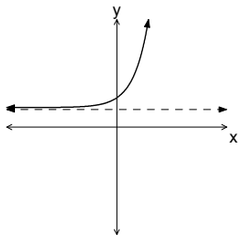


28. What is the range of $(y+3) = \left(\frac{1}{5}\right)^x$?

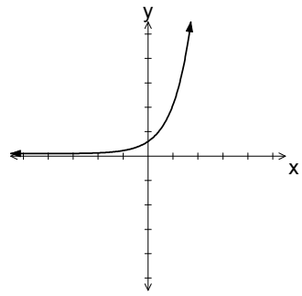
(A) $\{y \mid y > -3, y \in R\}$
(B) $\{y \mid y \geq -3, y \in R\}$
(C) $\{y \mid y > 3, y \in R\}$
(D) $\{y \mid y \geq 3, y \in R\}$

29. The temperature, T, of a cup of hot chocolate with respect to time, m, in minutes is given by the equation below. What is the initial temperature, in degrees Celsius, of the hot chocolate?

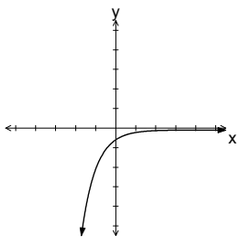
$$T = 73(0.90)^m + 22$$

(A) 22
(B) 73
(C) 90
(D) 95

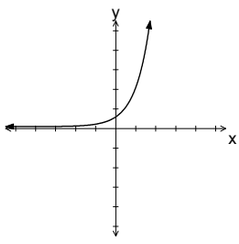
30. Which represents the inverse of the graph of $f(x)$ shown below?



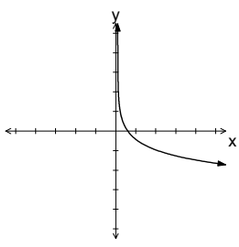
(A)



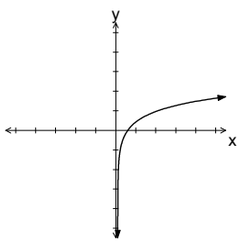
(B)



(C)



(D)



31. Which is equivalent to $\log_5(x+2) = y$?

(A) $5^x = y - 2$
(B) $5^x = y + 2$
(C) $5^y = x - 2$
(D) $5^y = x + 2$

32. Write as a single logarithm: $4\log A - \log B^3 + 2\log C$.

(A) $\log\left(A^4B^3C^2\right)$
(B) $\log\left(\frac{A^4C^2}{B^3}\right)$
(C) $\frac{\log A^4C^2}{\log B^3}$
(D) $8\log\left(\frac{AC}{B^3}\right)$

33. What is the exact value of x for $3^{x+1} = 15$?

(A) $\frac{\log 3}{\log 15} - 1$

(B) $\frac{\log 3}{\log 15} + 1$

(C) $\frac{\log 15}{\log 3} - 1$

(D) $\frac{\log 15}{\log 3} + 1$

34. Solve for x: $2\log_2 x + \log_2 4 = \log_2 64$.

(A) 4
(B) ± 4
(C) 16
(D) ± 16

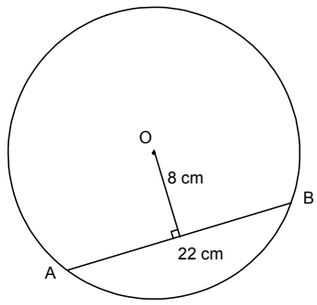
35. Evaluate: $\frac{1}{2}\log_3 36 - \log_3 2$.

(A) 1
(B) 2
(C) $\log_3 12$
(D) $\log_3 36$

36. Solve for x: $2\log_3 (x+1) = 4$.

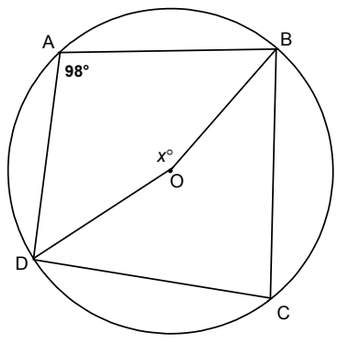
(A) 1
(B) 5
(C) 8
(D) 40

37. In the circle with centre O shown, chord $\overline{AB}$ is 22 cm long and is 8 cm from the centre. What is the length, in cm, of the diameter of the circle?



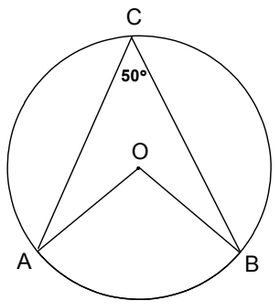
(A) 13.6
(B) 15.0
(C) 20.5
(D) 27.2

38. In the circle with centre O shown, $\angle DAB = 98°$. What is the value of x, in degrees?



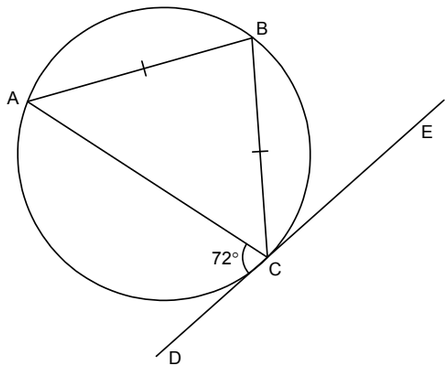
(A) 82
(B) 98
(C) 164
(D) 196

39. In the circle with centre O shown, $\angle ACB = 50°$. What is the measure, in degrees, of major arc $\overset{\frown}{ACB}$?



(A) 100
(B) 260
(C) 310
(D) 335

40. In the circle shown $\angle ACD = 72°$ and $\overline{DE}$ is tangent to the circle at C. What is the measure, in degrees, of $\angle BAC$?



(A) 18
(B) 36
(C) 54
(D) 72

41. What are the coordinates of the centre of the circle represented by $x^2 + y^2 - 4y = 12$?

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

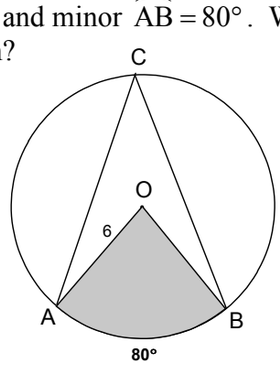
42. What is the length of the major axis of the ellipse represented by $4(x+3)^2 + 25(y-5)^2 = 100$?

(A) 2
(B) 4
(C) 5
(D) 10

43. What is the converse of the statement, "If a triangle is isosceles then the base angles are congruent"?

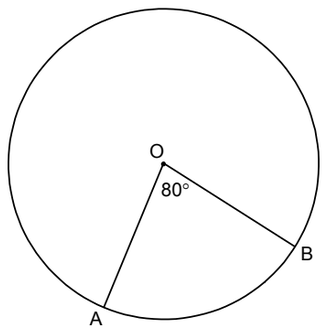
(A) A triangle is isosceles *iff* the two base angles are congruent.
(B) If a triangle is not isosceles then the base angles are not congruent.
(C) If the base angles of a triangle are congruent then the triangle is isosceles.
(D) The two base angles of a triangle are congruent *iff* the triangle is isosceles.

44. In the circle with centre O shown, the radius is 6 units and minor $\overset{\frown}{AB} = 80°$. What is the approximate area, in square units, of the shaded region?



(A) 4.19
(B) 8.38
(C) 12.57
(D) 25.13

45. In the circle with centre O shown, what is the length of minor $\overset{\frown}{AB}$ if the circumference of the circle is 32π?



(A) 7.1
(B) 11.2
(C) 22.3
(D) 44.6

46. If point $P(1,0)$ is rotated $300°$ from standard position on a unit circle, what are the new coordinates of point P?

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

47. A circle with centre $C(6,-3)$ has a diameter $\overline{PQ}$ with one endpoint at $P(10,-7)$. What are the coordinates of point Q?

(A) $(-2,2)$
(B) $(-4,4)$
(C) $(2,1)$
(D) $(8,-5)$

48. Which equation represents a circle?

(A) $4x^2 - 4y^2 = 0$
(B) $4x^2 + 10y^2 - 8x + 20y - 70 = 0$
(C) $12x^2 - 20y^2 - 2x - 4y - 6 = 0$
(D) $16x^2 + 16y^2 - 12x + 2y - 18 = 0$

49. The endpoints of the major vertical axis of an ellipse are $(0,-5)$ and $(0,5)$. What is the vertical stretch factor of the ellipse as compared to the unit circle?

(A) $\frac{1}{5}$
(B) $\frac{1}{\sqrt{5}}$
(C) $\sqrt{5}$
(D) 5

50. What is the approximate measure of θ, in degrees, if the point $P(8,-6)$ is on the terminal arm of θ in standard position?

(A) 306.9
(B) 311.4
(C) 318.6
(D) 323.1

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 $\frac{4}{x} = \frac{x-6}{x-3}$.

4 52. A square and a rectangle have the same width x. The rectangle's length is 1 cm more than twice the width. When the area of the square is subtracted from the area of the rectangle, the result is 56. Algebraically determine the width of the square and the rectangle.

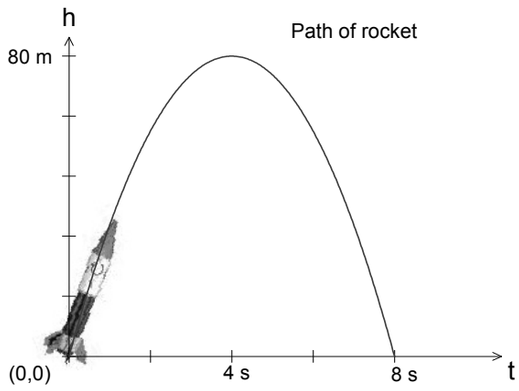
Value

4 53. A soccer ball is kicked and follows a parabolic path described by the function $h(t) = -5t^2 + 15t + 0.2$, where t is the time in seconds after the ball is kicked and $h(t)$ is the height of the ball above ground, in metres.

a) What is the initial height of the ball? _____

b) Algebraically determine the maximum height reached by the ball.

4 54. A toy rocket is launched into the air and reaches a maximum height of 80 m after a time of 4 seconds. If the rocket lands after 8 seconds, determine the quadratic function that describes the flight path of the rocket. Use the function to determine the height of the rocket at 6.5 seconds.



Value

4 55. A ball is thrown vertically upward with an initial speed of 30 m/s. Its height, in metres, t seconds after release is given by $h(t) = 1 + 30t - 5t^2$. Calculate the instantaneous rate of change at 2.5 seconds and describe how the height of the ball is changing at that instant.

4 56. Algebraically solve for x: $\frac{1}{3}\log_2 125 + \log_2(x+2) = 4$.

4 57. Algebraically solve for x: $\left(\frac{1}{36}\right)^{2x+1} - 6 = 210$.

Value

4 58. A radioactive substance has a half-life of 17 days. Write a function to model this situation and use it to determine the time it will take for 300 g of this substance to decay to 95 g.

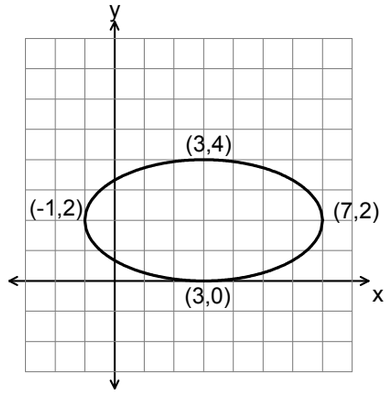
4 59. The table below shows the value of a house that is appreciating over time. Create a function that describes the value of the house and use it to determine its value after 18 years.

Time (years)	0	5	10	15
Value ($)	200 000	224 000	250 880	280 985.6

Value

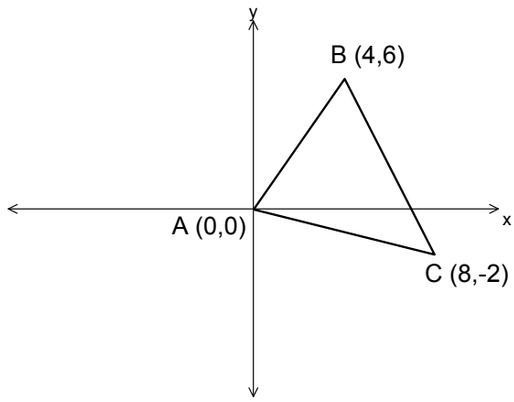
3 60. Write $x^2 + 4y^2 - 10x + 24y - 3 = 0$ in transformational form and state the coordinates of the centre.

3 61. Write, in transformational form, the equation for the ellipse shown.



Value

4 62. In ΔABC the coordinates of the vertices are A(0,0), B(4,6), and C(8,-2). Prove that the segment joining the midpoints of $\overline{AB}$ and $\overline{BC}$ is one half the length of $\overline{AC}$.



4 63. In the circle with centre O shown, minor $\overset{\frown}{AB} = 85°$. Calculate the area of the shaded region.