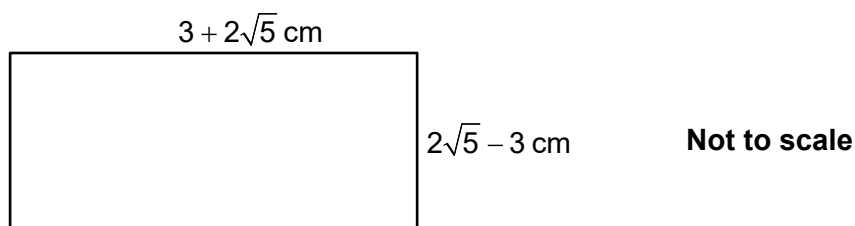


Higher Check In – 3.03 Exact calculations

Do not use a calculator.

1. Simplify $\sqrt{45}$.
2. Find the exact area of a semicircle with a diameter of 8 m.
3. Simplify $\sqrt{18} - \sqrt{8} + \sqrt{12}$.
4. The lengths of the diagonals of a kite are $\sqrt{11}$ cm and $(6 + 2\sqrt{11})$ cm. Work out the exact area of the kite.
5. Rationalise and simplify $\frac{1}{\sqrt{8}}$.
6. Show that the area of this rectangle is a prime number.



7. A circle has area $\frac{49}{4}\pi$ cm². Show that the circumference of this circle is 7π cm.
8. The area of a square is 48 cm². Show that length of a diagonal of the square is $4\sqrt{6}$ cm.
9. A rectangle has area 12 m². The length of the rectangle is $4 - 2\sqrt{3}$ m. Find the exact width of the rectangle, giving your answer in the form $a + b\sqrt{3}$.
10. A cylinder made of solid brass has diameter 6 cm and height 8 cm. The cylinder is melted down and made into a new cylinder with height 6 cm. What is the exact diameter of the new cylinder?

Extension

Solve these simultaneous equations.

$$x + \sqrt{3}y = 6\sqrt{3}$$

$$\sqrt{3}x + y = 8$$



Answers

1. $3\sqrt{5}$

2. $8\pi \text{ m}^2$

3. $3\sqrt{2} - 2\sqrt{2} + 2\sqrt{3} = 2\sqrt{3} + \sqrt{2}$

4. $\frac{\sqrt{11} \times (6 + 2\sqrt{11})}{2} = \frac{6\sqrt{11} + 22}{2} = (3\sqrt{11} + 11) \text{ cm}$

5. $\frac{1}{\sqrt{8}} \times \frac{\sqrt{8}}{\sqrt{8}} = \frac{\sqrt{8}}{8} = \frac{2\sqrt{2}}{8} = \frac{\sqrt{2}}{4}$

6. $(3 + 2\sqrt{5})(2\sqrt{5} - 3) = 6\sqrt{5} - 9 + 4 \times 5 - 6\sqrt{5} = -9 + 20 = 11$ which is prime.

7. For a circle, area = πr^2 so $\frac{49}{4}\pi = \pi r^2$ which gives $r^2 = \frac{49}{4}$ so $r = \frac{7}{2}$.

Since circumference = $2\pi r$, then circumference = $2\pi \times \frac{7}{2} = 7\pi$.

8. If area = 48 then each side has length = $\sqrt{48}$.

By Pythagoras' theorem, the diagonal has length:

$$\sqrt{\sqrt{48}^2 + \sqrt{48}^2} = \sqrt{48 + 48} = \sqrt{96} = \sqrt{16 \times 6} = 4\sqrt{6} \text{ cm.}$$

9. $12 + 6\sqrt{3}$

10. $4\sqrt{3} \text{ cm}$

Extension

$$x = \sqrt{3}, y = 5$$

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Simplify a surd			
AO1	2	Use multiples of π in an exact calculation of the area of a semicircle			
AO1	3	Simplify an expression containing surds			
AO1	4	Use surds in an exact calculation of the area of a kite			
AO1	5	Simplify an expression with surds, including rationalising the denominator			
AO2	6	Use surds in an exact area calculation of the area of a rectangle			
AO2	7	Use multiples of π in an exact calculation of the circumference of a circle from the area of a circle			
AO2	8	Use surds in an exact calculation of a diagonal of a square			
AO3	9	Use surds in an exact calculation of a length of a rectangle			
AO3	10	Solve a volume problem using multiples of π and surds			

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