# Test answers - Surds and exact values

Year: Year 10 · Duration: 45 minutes · /20

## Answer to Question 1 (4 marks)

a. Area $= \pi \times 25 = 25\pi$ **cm²** (1). Circumference $= 10\pi$ **cm** (1) Halve the diameter to get the radius 5 cm, then use $A = \pi r^2$ and $C = \pi d$. The area is $25\pi$ cm² and the circumference is $10\pi$ cm.

b. $\frac{60}{360} \times \pi \times 36 = 6\pi$ **cm²** (1 for method, 1 for the answer) The sector is $\frac{60}{360} = \frac{1}{6}$ of the circle of area $36\pi$. The area of the sector is $6\pi$ cm².

## Answer to Question 2 (4 marks)

a. $\sqrt{25 + 100} = \sqrt{125}$ (1) $= 5\sqrt{5}$ **cm** (1) Use Pythagoras for the hypotenuse, then simplify with the largest square factor: $\sqrt{125} = \sqrt{25 \times 5} = 5\sqrt{5}$.

b. $\frac{1}{2} \times 5 \times 10 =$ **25 cm²** (1) The two shorter sides are perpendicular, so they are the base and the height. The area is 25 cm².

c. $5 + 10 + 5\sqrt{5} = 15 + 5\sqrt{5}$ (1) Add the three sides. The perimeter is $15 + 5\sqrt{5}$ cm, so $k = 5$.

Check (a) with a calculator: $5\sqrt{5} \approx 11.18$, and $\sqrt{125} \approx 11.18$.

## Answer to Question 3 (4 marks)

a. $5\sqrt{3} + 3\sqrt{3} = 8\sqrt{3}$ (1 for each simplified surd, 1 for the sum) Simplify each surd: $\sqrt{75} = \sqrt{25 \times 3} = 5\sqrt{3}$ and $\sqrt{27} = \sqrt{9 \times 3} = 3\sqrt{3}$. Then add the like surds.

b. $16 - 3 =$ **13** (1) This is a difference of two squares: $4^2 - (\sqrt{3})^2 = 16 - 3$.

c. $4 + 4\sqrt{5} + 5 = 9 + 4\sqrt{5}$ (1) Expand $(2 + \sqrt{5})(2 + \sqrt{5})$: there are two middle terms of $2\sqrt{5}$, and $\sqrt{5} \times \sqrt{5} = 5$.

Check (b): the product has no surd because the middle terms $-4\sqrt{3}$ and $+4\sqrt{3}$ cancel. A common error in (c) is to write $(2 + \sqrt{5})^2 = 4 + 5 = 9$, forgetting the middle terms.

## Answer to Question 4 (4 marks)

a. $\frac{14\sqrt{7}}{7} = 2\sqrt{7}$ (1, 1) Multiply the top and bottom by $\sqrt{7}$, then simplify $\frac{14}{7} = 2$. The

answer is $2\sqrt{7}$.

b. $\frac{6(3+\sqrt{3})}{9-3}$ (1) $= 3+\sqrt{3}$ (1) Multiply the top and bottom by the conjugate $3+\sqrt{3}$. The bottom is $9-3=6$, and $\frac{6}{6}=1$. The answer is $3+\sqrt{3}$, so $a=3$ and $b=1$.

Check (b) with a calculator: $6 \div (3-1.732) \approx 4.732$ and $3+\sqrt{3} \approx 4.732$. Using $3-\sqrt{3}$ instead of the conjugate leaves a surd in the denominator.

## Answer to Question 5 (4 marks)

a. $\sqrt{25+144} =$ **13 cm** (1) The radius, the height and the slant height form a right-angled triangle. The slant height is 13 cm.

b. $\frac{1}{3}\pi \times 25 \times 12 = 100\pi$ **cm³** (1) Use $V = \frac{1}{3}\pi r^2 h$ with $r=5$ and $h=12$. The volume is $100\pi$ cm³.

c. $\pi \times 5 \times 13 = 65\pi$ **cm²** (1) Use $\pi r l$ with the slant height $l=13$. The curved surface area is $65\pi$ cm².

d. $65\pi + 25\pi = 90\pi$ **cm²** (1) Add the circular base, $\pi \times 5^2 = 25\pi$. The total surface area is $90\pi$ cm².