

Answer Key: An Introduction to Surds

Part 1: Square roots on the calculator

Q1.

$\sqrt{16}$	4	No
$\sqrt{2}$	1.4142	Yes
$\sqrt{49}$	7	No
$\sqrt{3}$	1.7320	Yes
$\sqrt{10}$	3.1622	Yes

Surds: $\sqrt{2}, \sqrt{3}, \sqrt{10}$. Non-surds: $\sqrt{16}, \sqrt{49}$.

Part 2: Surds that are equal

Q2. (a) $2\sqrt{2} = 2.8284$, $\sqrt{12} = 3.4641$, $\sqrt{6} = 2.4494$, $\sqrt{18} = 4.2426$, $\sqrt{20} = 4.4721$, $2\sqrt{3} = 3.4641$, $\sqrt{8} = 2.8284$, $3\sqrt{5} = 6.7082$, $2\sqrt{5} = 4.4721$, $3\sqrt{2} = 4.2426$.

(b) $2\sqrt{2} = \sqrt{8}$, $\sqrt{12} = 2\sqrt{3}$, $\sqrt{18} = 3\sqrt{2}$, $\sqrt{20} = 2\sqrt{5}$. Unpaired: $\sqrt{6}$, $3\sqrt{5}$.

Q3. (a) $2\sqrt{3}$ (b) $5\sqrt{2}$ (c) $2\sqrt{6}$ (d) $2\sqrt{7}$ (e) $3\sqrt{5}$ (f) $3\sqrt{7}$ (g) $5\sqrt{3}$ (h) $7\sqrt{2}$

Part 3: Adding and subtracting surds

Q4. (a) $6x$ (b) $3y$ (c) $4a$ (d) $5m$ (e) $5x + 2y$ (f) cannot be simplified.

Q5. (a) $5\sqrt{5}$ (b) $5\sqrt{7}$ (c) $5\sqrt{2}$ (d) $8\sqrt{6}$ (e) $5\sqrt{11}$ (f) $5\sqrt{5}$ (g) $6\sqrt{3}$ (h) $7\sqrt{2} + 3\sqrt{7}$ (i) cannot be simplified (j) 0

Q6. (a) $8\sqrt{2}$ cm (b) $9\sqrt{5}$ cm

Q7. (a) $3\sqrt{2}$ (b) $3\sqrt{3}$ (c) $2\sqrt{2}$ (d) $5\sqrt{5}$

Part 4: Multiplying and dividing surds

Q8. (a) $\sqrt{14}$ (b) $15\sqrt{14}$ (c) $\sqrt{21}$ (d) 6 (e) 6 (f) 10 (g) $6\sqrt{10}$ (h) $8\sqrt{21}$ (i) $5\sqrt{6}$ (j) 45

Q9. (a) $\sqrt{3}$ (b) $2\sqrt{3}$ (c) $\sqrt{5}$ (d) $\sqrt{11}$ (e) 2 (f) 3 (g) $2\sqrt{3}$ (h) $4\sqrt{5}$

Q10. (a) 4 cm^2 (b) $10\sqrt{6} \text{ cm}^2$ (c) $\sqrt{7} \text{ cm}$

Part 5: Many ways to make a surd

Q11. One valid completion for each middle surd:

Middle surd	Addition	Subtraction	Multiplication	Division	Single square root
$5\sqrt{2}$	$\sqrt{2} + 4\sqrt{2}$	$8\sqrt{2} - 3\sqrt{2}$	$\sqrt{25} \times \sqrt{2}$	$10\sqrt{6} \div 2\sqrt{3}$	$\sqrt{50}$
$3\sqrt{5}$	$\sqrt{5} + 2\sqrt{5}$	$4\sqrt{5} - \sqrt{5}$	$\sqrt{9} \times \sqrt{5}$	$6\sqrt{10} \div 2\sqrt{2}$	$\sqrt{45}$
$6\sqrt{2}$	$2\sqrt{2} + 4\sqrt{2}$	$7\sqrt{2} - \sqrt{2}$	$\sqrt{36} \times \sqrt{2}$	$12\sqrt{6} \div 2\sqrt{3}$	$\sqrt{72}$
$2\sqrt{7}$	$\sqrt{7} + \sqrt{7}$	$5\sqrt{7} - 3\sqrt{7}$	$\sqrt{4} \times \sqrt{7}$	$6\sqrt{14} \div 3\sqrt{2}$	$\sqrt{28}$
$3\sqrt{2}$	$\sqrt{2} + 2\sqrt{2}$	$5\sqrt{2} - 2\sqrt{2}$	$\sqrt{9} \times \sqrt{2}$	$9\sqrt{6} \div 3\sqrt{3}$	$\sqrt{18}$