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# P1 Chapter 1: Algebra

## Surds

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## Recap:

A surd is a root of a number that does not simplify to a rational number.

Laws:

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

**Note:** A *rational* number is any which can be expressed as  $\frac{a}{b}$  where  $a, b$  are integers.  $\frac{2}{3}$  and  $\frac{4}{1} = 4$  are rational numbers, but  $\pi$  and  $\sqrt{2}$  are not.

$$\sqrt{3} \times 2$$

=

?

$$3\sqrt{5} \times 2\sqrt{5}$$

=

?

$$\sqrt{8} = \sqrt{4}\sqrt{2}$$

=

?

$$\sqrt{12} + \sqrt{27}$$

=

?

$$(\sqrt{8} + 1)(\sqrt{2} - 3)$$

=

?

=

?

=

?

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$$\sqrt{3} \times 2 = 2\sqrt{3}$$

$$3\sqrt{5} \times 2\sqrt{5} = 30$$

$$\sqrt{8} = \sqrt{4}\sqrt{2} = 2\sqrt{2}$$

$$\sqrt{12} + \sqrt{27} = 2\sqrt{3} + 3\sqrt{3} = 5\sqrt{3}$$

$$\begin{aligned}(\sqrt{8} + 1)(\sqrt{2} - 3) &= \sqrt{16} - 3\sqrt{8} + \sqrt{2} - 3 \\&= 4 - 6\sqrt{2} + \sqrt{2} - 3 \\&= 1 - 5\sqrt{2}\end{aligned}$$

# Exercise 1.5

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# Homework Exercise

1 Do not use your calculator for this exercise. Simplify:

a  $\sqrt{28}$

b  $\sqrt{72}$

c  $\sqrt{50}$

d  $\sqrt{32}$

e  $\sqrt{90}$

f  $\frac{\sqrt{12}}{2}$

g  $\frac{\sqrt{27}}{3}$

h  $\sqrt{20} + \sqrt{80}$

i  $\sqrt{200} + \sqrt{18} - \sqrt{72}$

j  $\sqrt{175} + \sqrt{63} + 2\sqrt{28}$

k  $\sqrt{28} - 2\sqrt{63} + \sqrt{7}$

l  $\sqrt{80} - 2\sqrt{20} + 3\sqrt{45}$

m  $3\sqrt{80} - 2\sqrt{20} + 5\sqrt{45}$

n  $\frac{\sqrt{44}}{\sqrt{11}}$

o  $\sqrt{12} + 3\sqrt{48} + \sqrt{75}$

2 Expand and simplify if possible:

a  $\sqrt{3}(2 + \sqrt{3})$

b  $\sqrt{5}(3 - \sqrt{3})$

c  $\sqrt{2}(4 - \sqrt{5})$

d  $(2 - \sqrt{2})(3 + \sqrt{5})$

e  $(2 - \sqrt{3})(3 - \sqrt{7})$

f  $(4 + \sqrt{5})(2 + \sqrt{5})$

g  $(5 - \sqrt{3})(1 - \sqrt{3})$

h  $(4 + \sqrt{3})(2 - \sqrt{3})$

i  $(7 - \sqrt{11})(2 + \sqrt{11})$

3 Simplify  $\sqrt{75} - \sqrt{12}$  giving your answer in the form  $a\sqrt{3}$ , where  $a$  is an integer.

(2 marks)

# Homework Answers

1   a  $2\sqrt{7}$       b  $6\sqrt{2}$       c  $5\sqrt{2}$       d  $4\sqrt{2}$   
    e  $3\sqrt{10}$       f  $\sqrt{3}$       g  $\sqrt{3}$       h  $6\sqrt{5}$   
    i  $7\sqrt{2}$       j  $12\sqrt{7}$       k  $-3\sqrt{7}$       l  $9\sqrt{5}$   
    m  $23\sqrt{5}$       n 2      o  $19\sqrt{3}$

2   a  $2\sqrt{3} + 3$       b  $3\sqrt{5} - \sqrt{15}$   
    c  $4\sqrt{2} - \sqrt{10}$       d  $6 + 2\sqrt{5} - 3\sqrt{2} - \sqrt{10}$   
    e  $6 - 2\sqrt{7} - 3\sqrt{3} + \sqrt{21}$       f  $13 + 6\sqrt{5}$   
    g  $8 - 6\sqrt{3}$       h  $5 - 2\sqrt{3}$   
    i  $3 + 5\sqrt{11}$

3    $3\sqrt{3}$