1.1 Fractions

1 **a** $\frac{5}{9}$ **b** $\frac{15}{16}$ **c** $\frac{1}{6}$ **d** $\frac{4}{15}$

2 **a** $\frac{11}{15}$ **b** $\frac{1}{2}$ **c** $\frac{11}{20}$ **d** $\frac{9}{10}$

3 **a** $\frac{8}{3}$ **b** $\frac{23}{5}$ **c** $\frac{62}{11}$ **d** $\frac{25}{9}$

4 **a** $\frac{35}{2}$ **b** $-\frac{4}{3}$ **c** $-\frac{5}{4}$ **d** $\frac{15}{8}$

5 **a** $\frac{12}{5}$ **b** $\frac{32}{5}$ **c** $\frac{15}{8}$ **d** $\frac{8}{15}$

6 **a** $\frac{11}{3}$ **b** $\frac{11}{6}$ **c** $\frac{23}{6}$ **d** $\frac{1}{9}$ **e** $\frac{17}{20}$ **f** $\frac{4}{5}$

7 **a** $\frac{1}{3}$ **b** 4

8 **a** 59°F **b** $18\frac{1}{2}$ °F (or $\frac{37}{2}$ °F)

9 **a** $5\frac{5}{6}$ miles (or $\frac{35}{6}$ miles) **b** 6 km

10 **a** $\frac{8}{3}$ **b** $-\frac{3}{10}$ **c** $-\frac{7}{11}$ **d** $\frac{4}{5}$

11 **a** Hint: Solve $4\frac{2}{5} \times w = 11$ by converting $4\frac{2}{5}$ to a top-heavy fraction.

b $13\frac{4}{5}$ m

1.2 Surds

1 **a** $7\sqrt{5}$ **b** $6\sqrt{6}$ **c** $2\sqrt{2}$

d 20 **e** $-16\sqrt{2}$ **f** $2\sqrt{7}$

2 **a** $5\sqrt{5}$ **b** $\sqrt{2}$ **c** $-4\sqrt{3}$

3 3

4 **a** $4 + 3\sqrt{2}$ **b** $1 - 3\sqrt{3}$ **c** $1 + 5\sqrt{2}$

d $10 + 4\sqrt{6}$ **e** $2 + 7\sqrt{3}$ **f** $5 + 2\sqrt{6}$

5 **a** $2 - \sqrt{3}$ **b** $6 + 2\sqrt{3}$ **c** $6 - 2\sqrt{3}$

6 **a** $11 + 4\sqrt{7}$ **b** $5 + 2\sqrt{3}$ **c** $-5 - 3\sqrt{3}$

7 -2

8 **a** **i** $2\sqrt{2}$ **ii** $2\sqrt{10}$

b Because $D = -3b^2 < 0$ for any $b \neq 0$ and the square root of a negative number does not have a real value.

9 **a** $5\sqrt{3}$ **b** $6\sqrt{5}$ **c** $8\sqrt{3}$ **d** $9\sqrt{6}$

10 **a** 2

b Hint: Show $(4 \pm 2\sqrt{3})^2 = 28 \pm 16\sqrt{3}$ and then use Pythagoras' theorem.

c $8 + 2\sqrt{14}$, $a = 8$, $b = 2$

11 **a** $2 + 2\sqrt{3}$

b Hint: Show the three numbers obey Pythagoras' theorem $c^2 = a^2 + b^2$, where $c = 2 + 2\sqrt{3}$

c $3 + 2\sqrt{3}$, $a = 3$, $b = 2$

12 **a** $6 + 2\sqrt{5}$

b Hint: Use Pythagoras' theorem to find a shorter side.

c $2 + 2\sqrt{5}$

d Both equal $10 + 6\sqrt{5}$