



CAMI Mathematics: Grade 11

GRADE 11_Operations with surds

11.4 Operations with surds

1. Multiplying and dividing surds

(a) $\frac{\sqrt{2} \times \sqrt{14}}{\sqrt{7}}$

(b) $(4\sqrt{4} - 3)(4\sqrt{4} + 3)$

(c) $(\sqrt{2} + 3)^2$

(d) $\frac{\sqrt{150} \times \sqrt{6} \times \sqrt{7}}{5 \times 6}$

(e) $(7 - \sqrt{5})(7 + \sqrt{5})$

2. Adding surds

(a) $\sqrt{27} + \sqrt{108} + \sqrt{75} + 6\sqrt{3}$

(b) $\sqrt{252} - \sqrt{63} - (\sqrt{28} + 6\sqrt{7})$

(c) $-\sqrt{12} + (\sqrt[3]{135} - \sqrt{75})$

(d) $-\sqrt{50} - \sqrt{18} - \sqrt{45} - \sqrt{125}$

(e) $\sqrt{48} + (\sqrt[3]{128} + \sqrt{12})$

3. Rationalizing denominators

(a) $\frac{\sqrt{3}}{\sqrt{5}}$

(b) $\sqrt{\frac{5}{6}}$

(c) $\frac{2}{\sqrt{3}}$

(d) $\frac{3 + \sqrt{3}}{\sqrt{5}}$

(e) $\frac{-7 - \sqrt{6}}{\sqrt{7}}$

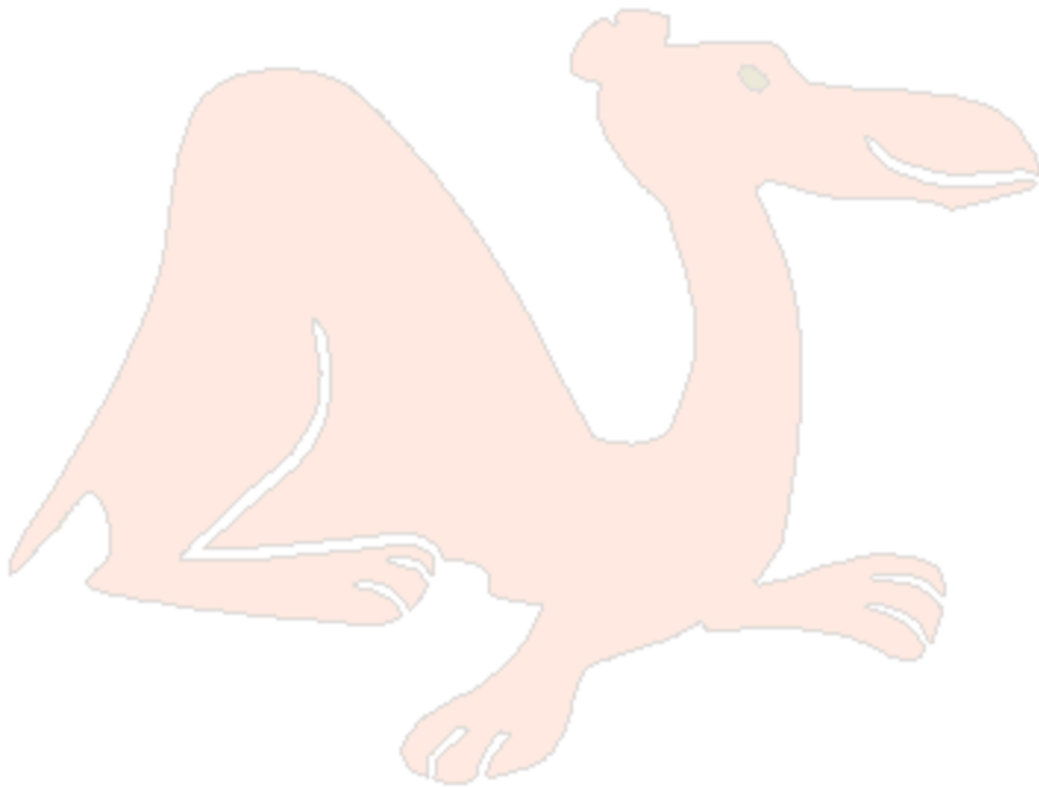
(e) $\frac{-6 + \sqrt{11}}{\sqrt{7}}$



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(f) $\frac{3}{2-4\sqrt{2}}$

(g) $\frac{5}{6+2\sqrt{3}}$





MEMO

1. Multiplying and dividing surds [4.3.6.2; 4.3.6.3]

(a)

$$\frac{\sqrt{2} \times \sqrt{14}}{\sqrt{7}} = \frac{\sqrt{2} \times \sqrt{2} \times \sqrt{7}}{\sqrt{7}} = 2$$

(b)

$$\begin{aligned} & (4\sqrt{4} - 3)(4\sqrt{4} + 3) \\ &= 16 \times 4 + 3\sqrt{4} - 3\sqrt{4} - 9 \\ &= 64 - 9 \\ &= 55 \end{aligned}$$

(c)

$$\begin{aligned} & (\sqrt{2} + 3)^2 \\ &= (\sqrt{2} + 3)(\sqrt{2} + 3) \\ &= 2 + 3\sqrt{2} + 3\sqrt{2} + 9 \\ &= 11 + 6\sqrt{2} \end{aligned}$$

(d)

$$\begin{aligned} & \frac{\sqrt{150} \times \sqrt{6} \times \sqrt{7}}{5 \times 6} \\ &= \frac{5\sqrt{6} \times \sqrt{6} \times \sqrt{7}}{5 \times 6} \\ &= \frac{5 \times 6 \times \sqrt{7}}{5 \times 6} \\ &= \sqrt{7} \end{aligned}$$

(e)

$$\begin{aligned} & (7 - \sqrt{5})(7 + \sqrt{5}) \\ &= 49 + 7\sqrt{5} - 7\sqrt{5} - 5 \\ &= 49 - 5 \\ &= 44 \end{aligned}$$



2. Adding surds [4.3.6.5; 4.3.6.6]

(a)

$$\begin{aligned}\sqrt{27} + \sqrt{108} + \sqrt{75} + 6\sqrt{3} \\ = 3\sqrt{3} + 6\sqrt{3} + 5\sqrt{3} + 6\sqrt{3} \\ = 20\sqrt{3}\end{aligned}$$

(b)

$$\begin{aligned}\sqrt{252} - \sqrt{63} - (\sqrt{28} + 6\sqrt{7}) \\ = 6\sqrt{7} - 3\sqrt{7} - 2\sqrt{7} - 6\sqrt{7} \\ = -5\sqrt{7}\end{aligned}$$

(c)

$$\begin{aligned}-\sqrt{12} + (\sqrt[3]{135} - \sqrt{75}) \\ = -2\sqrt{3} + 3\sqrt[3]{5} - 5\sqrt{3} \\ = -7\sqrt{3} + 3\sqrt[3]{5}\end{aligned}$$

(d)

$$\begin{aligned}-\sqrt{50} - \sqrt{18} - \sqrt{45} - \sqrt{125} \\ = -5\sqrt{2} - 3\sqrt{2} - 3\sqrt{5} - 5\sqrt{5} \\ = -8\sqrt{2} - 8\sqrt{5}\end{aligned}$$

(e)

$$\begin{aligned}\sqrt{48} + (\sqrt[3]{128} + \sqrt{12}) \\ = 4\sqrt{3} + 4\sqrt[3]{2} + 2\sqrt{3} \\ = 6\sqrt{3} + 4\sqrt[3]{2}\end{aligned}$$

3. Rationalizing denominators [4.3.6.7; 4.3.6.8; 4.3.6.9]

(a) $\frac{\sqrt{3}}{\sqrt{5}} = \frac{\sqrt{3}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{15}}{5}$

(b) $\sqrt{\frac{5}{6}} = \frac{\sqrt{5}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{30}}{6}$



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$$(c) \frac{2}{\sqrt{3}} = \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

$$(d) \frac{3+\sqrt{3}}{\sqrt{5}} = \frac{(3+\sqrt{3})}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{3\sqrt{5}+\sqrt{15}}{5}$$

$$(e) \frac{-7-\sqrt{6}}{\sqrt{7}} = \frac{(-7-\sqrt{6})}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{-7\sqrt{7}-\sqrt{42}}{7}$$

$$(e) \frac{-6+\sqrt{11}}{\sqrt{7}} = \frac{-6+\sqrt{11}}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{-6\sqrt{7}+\sqrt{77}}{7}$$

(f)

$$\begin{aligned} & \frac{3}{2-4\sqrt{2}} \\ &= \frac{3}{(2-4\sqrt{2})} \times \frac{(2+4\sqrt{2})}{(2+4\sqrt{2})} \\ &= \frac{3(2+4\sqrt{2})}{4-16 \times 2} \\ &= \frac{6+12\sqrt{2}}{-28} \end{aligned}$$

(g)

$$\begin{aligned} & \frac{5}{6+2\sqrt{3}} \\ &= \frac{5}{(6+2\sqrt{3})} \times \frac{(6-2\sqrt{3})}{(6-2\sqrt{3})} \\ &= \frac{5(6-2\sqrt{3})}{36-4 \times 3} \\ &= \frac{30-10\sqrt{3}}{24} \end{aligned}$$