

JAN 2005 - MAY 2009

$$\begin{aligned}
 1) \quad & (3 + \sqrt{2})(3 - \sqrt{2}) \\
 &= 9 + 3\sqrt{2} - 3\sqrt{2} - 2 \\
 &= 7
 \end{aligned}$$

Easier to consider as the difference of two squares

$$a^2 - b^2 = (a+b)(a-b)$$

$$\begin{aligned}
 \text{so } & (3 + \sqrt{2})(3 - \sqrt{2}) \\
 &= 3^2 - \sqrt{2}^2 \\
 &= 9 - 2 = 7
 \end{aligned}$$

$$\begin{aligned}
 & \frac{1 + \sqrt{2}}{3 - \sqrt{2}} \\
 = & \frac{1 + \sqrt{2}}{3 - \sqrt{2}} \times \frac{3 + \sqrt{2}}{3 + \sqrt{2}} \\
 = & \frac{(1 + \sqrt{2})(3 + \sqrt{2})}{7}
 \end{aligned}$$

$$= \frac{3 + 3\sqrt{2} + \sqrt{2} + 2}{7}$$

$$= \frac{5 + 4\sqrt{2}}{7}$$

$$= \frac{5}{7} + \frac{4}{7}\sqrt{2}$$

$$\begin{aligned}
 2) \text{ i) } & \sqrt{24} + \sqrt{6} \\
 &= \sqrt{4 \times 6} + \sqrt{6} \\
 &= 2\sqrt{6} + \sqrt{6} = 3\sqrt{6}
 \end{aligned}$$

$$\begin{aligned}
 \text{ii) } & \frac{36}{5 - \sqrt{7}} \\
 = & \frac{36}{5 - \sqrt{7}} \times \frac{5 + \sqrt{7}}{5 + \sqrt{7}} \\
 = & \frac{36(5 + \sqrt{7})}{5^2 - \sqrt{7}^2}
 \end{aligned}$$

$$= \frac{180 + 36\sqrt{7}}{25 - 7}$$

$$= \frac{180 + 36\sqrt{7}}{18}$$

$$= 10 + 2\sqrt{7}$$

$$\begin{aligned}
 3) \text{ i) } & 5\sqrt{8} + 4\sqrt{50} \\
 &= 5\sqrt{4 \times 2} + 4\sqrt{25 \times 2} \\
 &= 10\sqrt{2} + 20\sqrt{2} = 30\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{ii) } & \frac{\sqrt{3}}{6 - \sqrt{3}} \\
 = & \frac{\sqrt{3}}{6 - \sqrt{3}} \times \frac{6 + \sqrt{3}}{6 + \sqrt{3}}
 \end{aligned}$$

3ii)
cont)

$$= \frac{\sqrt{3}(6+\sqrt{3})}{6^2 - \sqrt{3}^2}$$

$$= \frac{6\sqrt{3} + 3}{36 - 3}$$

$$= \frac{6\sqrt{3} + 3}{33}$$

$$= \frac{2}{11}\sqrt{3} + \frac{1}{11}$$

4)i) $6\sqrt{2} \times 5\sqrt{3} - \sqrt{24}$

$$= 30\sqrt{6} - \sqrt{4 \times 6}$$

$$= 30\sqrt{6} - 2\sqrt{6}$$

$$= 28\sqrt{6}$$

ii) $(2 - 3\sqrt{5})^2$

$$= (2 - 3\sqrt{5})(2 - 3\sqrt{5})$$

$$= 4 - 6\sqrt{5} - 6\sqrt{5} + 9 \times 5$$

$$= 49 - 12\sqrt{5}$$

5) $a = \frac{3}{2}$

$$b = \frac{9 - \sqrt{17}}{4}$$

$$c = \frac{9 + \sqrt{17}}{4}$$

$$a + b + c =$$

$$\frac{6}{4} + \frac{9 - \sqrt{17}}{4} + \frac{9 + \sqrt{17}}{4}$$

$$= \frac{6 + 9 - \sqrt{17} + 9 + \sqrt{17}}{4}$$

$$= \frac{24}{4} = 6$$

$$bc = \frac{(9 - \sqrt{17})(9 + \sqrt{17})}{4 \times 4}$$

$$bc = \frac{9^2 - \sqrt{17}^2}{16}$$

$$bc = \frac{81 - 17}{16} = \frac{64}{16} = 4$$

$$abc = \frac{3}{2} \times 4 = 6$$

$$\therefore a + b + c = abc = 6$$

6)i) $\sqrt{98} - \sqrt{50}$

$$= \sqrt{49 \times 2} - \sqrt{25 \times 2}$$

$$= 7\sqrt{2} - 5\sqrt{2}$$

$$= 2\sqrt{2}$$

6ii) $\frac{6\sqrt{5}}{2 + \sqrt{5}}$

$$= \frac{6\sqrt{5}}{2 + \sqrt{5}} \times \frac{2 - \sqrt{5}}{2 - \sqrt{5}}$$

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$$\begin{aligned}
 \text{6ii) cont)} &= \frac{6\sqrt{5}(2-\sqrt{5})}{2^2-\sqrt{5}^2} \\
 &= \frac{12\sqrt{5}-30}{4-5} \\
 &= \frac{12\sqrt{5}-30}{-1} \\
 &= 30-12\sqrt{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{7) i)} &\quad \sqrt{48} + \sqrt{3} \\
 &= \sqrt{16 \times 3} + \sqrt{3} \\
 &= 4\sqrt{3} + \sqrt{3} = 5\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{ii)} &\quad \frac{1}{5+\sqrt{2}} + \frac{1}{5-\sqrt{2}} \\
 &= \frac{5-\sqrt{2} + 5+\sqrt{2}}{(5+\sqrt{2})(5-\sqrt{2})} \\
 &= \frac{10}{5^2-\sqrt{2}^2} \\
 &= \frac{10}{25-2} = \frac{10}{23}
 \end{aligned}$$

$$\begin{aligned}
 \text{8) i)} &\quad \frac{1}{5+\sqrt{3}} \\
 &= \frac{1}{5+\sqrt{3}} \times \frac{5-\sqrt{3}}{5-\sqrt{3}}
 \end{aligned}$$

$$\begin{aligned}
 &= \frac{5-\sqrt{3}}{5^2-\sqrt{3}^2} \\
 &= \frac{5-\sqrt{3}}{22}
 \end{aligned}$$

$$\begin{aligned}
 \text{8ii)} &\quad (3-2\sqrt{7})^2 \\
 &= (3-2\sqrt{7})(3-2\sqrt{7}) \\
 &= 9 - 6\sqrt{7} - 6\sqrt{7} + 4 \times 7 \\
 &= 37 - 12\sqrt{7}
 \end{aligned}$$

$$\begin{aligned}
 \text{9) i)} &\quad \sqrt{75} + \sqrt{48} \\
 &= \sqrt{25 \times 3} + \sqrt{16 \times 3} \\
 &= 5\sqrt{3} + 4\sqrt{3} = 9\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{ii)} &\quad \frac{14}{3-\sqrt{2}} \\
 &= \frac{14}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}} \\
 &= \frac{14(3+\sqrt{2})}{3^2-\sqrt{2}^2} \\
 &= \frac{42+14\sqrt{2}}{9-2} \\
 &= \frac{42+14\sqrt{2}}{7} \\
 &= 6+2\sqrt{2}
 \end{aligned}$$

10)

i)

$$\frac{\sqrt{48}}{2\sqrt{27}}$$

$$= \frac{\sqrt{16 \times 3}}{2\sqrt{9 \times 3}}$$

$$= \frac{4\sqrt{3}}{6\sqrt{3}}$$

$$= \frac{2}{3}$$

ii)

$$(5 - 3\sqrt{2})^2$$

$$= (5 - 3\sqrt{2})(5 - 3\sqrt{2})$$

$$= 25 - 15\sqrt{2} - 15\sqrt{2} + 9 \times 2$$

$$= 43 - 30\sqrt{2}$$

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