1. (a) Now
$$\sqrt{180} = \sqrt{2 \times 90} = \sqrt{2 \times 2 \times 45} = \sqrt{2 \times 2 \times 3 \times 15}$$

 $= \sqrt{2 \times 2 \times 3 \times 3 \times 5}$.
Then $\sqrt{180} = 2 \times 3 \times \sqrt{5}$. Hence the solution is $6\sqrt{5}$.
(b) $(\sqrt{6} + \sqrt{8})(\sqrt{4} - \sqrt{6}) = \sqrt{6} \times \sqrt{4} + \sqrt{6} \times (-\sqrt{6}) + \sqrt{8} \times \sqrt{4} + \sqrt{8} \times (-\sqrt{6}))$
 $= \sqrt{6} \times 4 - \sqrt{6} \times 6 + \sqrt{8} \times 4 - \sqrt{8} \times 6$
 $= \sqrt{24} - 6 + \sqrt{32} - \sqrt{48}$
 $= 2\sqrt{6} - 6 + 4\sqrt{2} - 4\sqrt{3}$
(c) $\sqrt{45} = 2\sqrt{10}$, so $\sqrt{5x} = \sqrt{2 \times 2 \times 10}$, so $5x = 40$. Hence $x = 8$.
(e) Solve $|-5x + 4| = 4$. Hence (1) $-5x + 4 = 4$ or (2) $-5x + 4 = -4$.
(1) $-5x + 4 = 4$, so $-5x = 4 - 4$, so $-5x = -6$, so $\frac{-5x}{-5} = \frac{-6}{-5}$, so $x = 0$.
(2) $-5x + 4 = -4$, so $-5x = -4 - 4$, so $-5x = -8$, so $\frac{-5x}{-5} = \frac{-8}{-5}$, so $x = \frac{8}{5}$.
Hence the solutions are $x = 0$ and $x = \frac{8}{5}$.
(f) $2 = 3x + 5$, so $2 - 5 = 3x$, so $-3 = 3x$.
Hence the solution is $x = -1$.
(g) $5x + 6 = 6$, so $5x = 6 - 6$, so $5x = 0$, so $\frac{5x}{5} = \frac{0}{5}$, so $x = 0$.
Hence the solution is $x = -1$.
(g) $5x + 6 = 8$, so $\frac{4x}{3} = 8 - 9$, so $\frac{4x}{3} = -1$, so $4x = -1 \times 3$,
so $4x = -3$, so $\frac{4x}{3} = \frac{-3}{4}$, so $x = \frac{-3}{4}$. Hence the solution is $x = -\frac{3}{4}$.
(i) $\frac{-2}{-3x} - 2 = -3$, so $\frac{2}{3x} = -3 + 2$, so $\frac{2}{3x} = -1$, so $2 = -1 \times 3x$, so $2 = -3x$,
so $x = \frac{2}{-3}$. Hence the solution is $x = -\frac{2}{3}$.
(j) Find x if $x = \frac{0}{4} + \frac{-1}{-4} = 0 + \frac{1}{4}$.
Hence the solution is $x = 1$.
(k) $x = \frac{0}{4} \div \frac{-4}{-5} = \frac{0}{4} \times \frac{5}{-4} = \frac{0}{-16} = 0$.
Hence the solution is $x = 0$.
2. (a) Now $\sqrt{45} = \sqrt{3 \times 15} = \sqrt{3 \times 3 \times 5}$.
Then $\sqrt{45} = 3 \times \sqrt{5}$. Hence the solution is $3\sqrt{5}$.

(b)
$$(\sqrt{2} + \sqrt{4})(\sqrt{3} - \sqrt{2}) = \sqrt{2} \times \sqrt{3} + \sqrt{2} \times (-\sqrt{2}) + \sqrt{4} \times \sqrt{3} + \sqrt{4} \times (-\sqrt{2})$$
$$= \sqrt{2 \times 3} - \sqrt{2 \times 2} + \sqrt{4 \times 3} - \sqrt{4 \times 2}$$
$$= \sqrt{6} - 2 + \sqrt{12} - \sqrt{8}$$
$$= \sqrt{6} - 2 + 2\sqrt{3} - 2\sqrt{2}$$

(c) $\sqrt{80} = x\sqrt{5}$. Now $\sqrt{80} = \sqrt{4 \times 4 \times 5} = 4\sqrt{5}$. Hence x = 4. (d) $\sqrt{8x} = 4\sqrt{3}$, so $\sqrt{8x} = \sqrt{4 \times 4 \times 3}$, so 8x = 48. Hence x = 6. (e) Solve |-2x+5|=3. Hence (1) -2x+5=3 or (2) -2x+5=-3. (1) -2x + 5 = 3, so -2x = 3 - 5, so -2x = -2, so $\frac{-2x}{-2} = \frac{-2}{-2}$, so x = 1. (2) -2x+5=-3, so -2x=-3-5, so -2x=-8, so $\frac{-2x}{-2}=\frac{-8}{-2}$, so x=4. Hence the solutions are x = 1 and x=4(f) -3 = 3x + 3, so -3 - 3 = 3x, so -6 = 3x. Hence the solution is x = -2. (g) 2x + 6 = 3, so 2x = 3 - 6, so 2x = -3, so $\frac{2x}{2} = \frac{-3}{2}$, so $x = -\frac{3}{2}$ Hence the solution is $x = -\frac{3}{2}$. (h) $\frac{4x}{3} - 3 = 8$, so $\frac{4x}{3} = 8 + 3$, so $\frac{4x}{3} = 11$, so $4x = 11 \times 3$, so 4x = 33, so $\frac{4x}{4} = \frac{33}{4}$. Hence the solution is $x = \frac{33}{4}$. (i) $\frac{-4}{-3x} + 6 = 1$, so $\frac{4}{3x} = 1 - 6$, so $\frac{4}{3x} = -5$, so $4 = -5 \times 3x$, so 4 = -15x, so $x = \frac{4}{-15}$. Hence the solution is $x = -\frac{4}{15}$. (j) Find x if $x = \frac{-1}{1} + \frac{3}{4} = \frac{-1}{1} \times \frac{4}{4} + \frac{3}{4} = \frac{-4}{4} + \frac{3}{4} = \frac{-4+3}{4} = \frac{-1}{4}$ Hence the solution is $x = -\frac{1}{4}$. (k) $x = \frac{-1}{-1} \times \frac{2}{3} = \frac{1}{1} \times \frac{2}{3} = \frac{2}{2}$. Hence the solution is $x = \frac{2}{3}$ **3.** (a) Now $\sqrt{48} = \sqrt{2 \times 24} = \sqrt{2 \times 2 \times 12} = \sqrt{2 \times 2 \times 2 \times 6}$ $=\sqrt{2\times2\times2\times2\times3}$ Then $\sqrt{48} = 2 \times 2 \times \sqrt{3}$. Hence the solution is $4\sqrt{3}$. $(\sqrt{2} + \sqrt{2})(\sqrt{8} - \sqrt{3}) = \sqrt{2} \times \sqrt{8} + \sqrt{2} \times (-\sqrt{3}) + \sqrt{2} \times \sqrt{8} + \sqrt{2} \times (-\sqrt{3})$ (b) $= \sqrt{2 \times 8} - \sqrt{2 \times 3} + \sqrt{2 \times 8} - \sqrt{2 \times 3}$ $= \sqrt{16} - \sqrt{6} + \sqrt{16} - \sqrt{6}$ $= 4 - \sqrt{6} + 4 - \sqrt{6}$ $= 4 + 4 - \sqrt{6} - \sqrt{6}$ $= 8 - 2\sqrt{6}$ (c) $\sqrt{96} = x\sqrt{6}$. Now $\sqrt{96} = \sqrt{4 \times 4 \times 6} = 4\sqrt{6}$. Hence x = 4. (d) $\sqrt{24x} = 4\sqrt{3}$, so $\sqrt{24x} = \sqrt{4 \times 4 \times 3}$, so 24x = 48. Hence x = 2. (e) Solve |-3x+5|=3. Hence (1) -3x+5=3 or (2) -3x+5=-3.

(1) -3x + 5 = 3, so -3x = 3 - 5, so -3x = -2, so $\frac{-3x}{-3} = \frac{-2}{-3}$, so $x = \frac{2}{3}$.

(2) -3x + 5 = -3, so -3x = -3 - 5, so -3x = -8, so $\frac{-3x}{-3} = \frac{-8}{-3}$, so $x = \frac{8}{3}$ Hence the solutions are $x = \frac{2}{3}$ and $x = \frac{8}{3}$. (f) 3 = 5x - 4, so 3 + 4 = 5x, so 7 = 5x. Hence the solution is $x = \frac{7}{5}$. (g) 2x + 4 = 5, so 2x = 5 - 4, so 2x = 1, so $\frac{2x}{2} = \frac{1}{2}$, so $x = \frac{1}{2}$. Hence the solution is $x = \frac{1}{2}$. (h) $\frac{-x}{-4} - 9 = 5$, so $\frac{x}{4} = 5 + 9$, so $\frac{x}{4} = 14$, so $x = 14 \times 4$. Hence the solution is x = 56. (i) $\frac{4}{3x} - 6 = 7$, so $\frac{4}{3x} = 7 + 6$, so $\frac{4}{3x} = 13$, so $4 = 13 \times 3x$, so 4 = 39x, . Hence the solution is $x = \frac{4}{39}$. (j) Find x if $x = \frac{-2}{2} - \frac{-1}{1} = \frac{-1}{1} + \frac{1}{1} = \frac{-1+1}{1} = \frac{0}{1}$. Hence the solution is x = 0(k) $x = \frac{5}{-4} \div \frac{-2}{-2} = \frac{5}{-4} \times \frac{-2}{-2} = \frac{-5}{4} \times \frac{1}{1} = \frac{-5}{4} = -\frac{5}{4}.$ Hence the solution is $x = -\frac{5}{4}$. 4. (a) Now $\sqrt{120} = \sqrt{2 \times 60} = \sqrt{2 \times 2 \times 30} = \sqrt{2 \times 2 \times 2 \times 15}$ $=\sqrt{2\times2\times2\times3\times5}.$ Then $\sqrt{120} = 2 \times \sqrt{2 \times 3 \times 5}$. Hence the solution is $2\sqrt{30}$. $(\sqrt{3} + \sqrt{2})(\sqrt{2} - \sqrt{6}) = \sqrt{3} \times \sqrt{2} + \sqrt{3} \times (-\sqrt{6}) + \sqrt{2} \times \sqrt{2} + \sqrt{2} \times (-\sqrt{6})$ (b) $=\sqrt{3\times 2}-\sqrt{3\times 6}+\sqrt{2\times 2}-\sqrt{2\times 6}$ $= \sqrt{6} - \sqrt{18} + 2 - \sqrt{12}$ $= \sqrt{6} - 3\sqrt{2} + 2 - 2\sqrt{3}$ (c) $\sqrt{125} = x\sqrt{5}$. Now $\sqrt{125} = \sqrt{5 \times 5 \times 5} = 5\sqrt{5}$. Hence x = 5. (d) $\sqrt{2x} = 4\sqrt{3}$, so $\sqrt{2x} = \sqrt{4 \times 4 \times 3}$, so 2x = 48. Hence x = 24. (e) Solve |-4x+5|=3. Hence (1) -4x+5=3 or (2) -4x+5=-3. (1) -4x + 5 = 3, so -4x = 3 - 5, so -4x = -2, so $\frac{-4x}{-4} = \frac{-2}{-4}$, so $x = \frac{1}{2}$. (2) -4x + 5 = -3, so -4x = -3 - 5, so -4x = -8, so $\frac{-4x}{-4} = \frac{-8}{-4}$, so x = 2. Hence the solutions are $x = \frac{1}{2}$ and x = 2. (f) -1 = 3x + 0, so -1 - 0 = 3x, so -1 = 3x. Hence the solution is $x = -\frac{1}{3}$ (g) 5x + 6 = 3, so 5x = 3 - 6, so 5x = -3, so $\frac{5x}{5} = \frac{-3}{5}$, so $x = -\frac{3}{5}$ Hence the solution is $x = -\frac{3}{5}$

(h)
$$\frac{2x}{2} - 9 = -7$$
, so $\frac{-x}{1} = -7 + 9$, so $\frac{-x}{1} = 2$, so $-x = 2 \times 1$,
so $-x = 2$. Hence the solution is $x = -2$.
(i) $\frac{3}{-2x} - 1 = -2$, so $\frac{-3}{2x} = -2 + 1$, so $\frac{-3}{2x} = -1$, so $-3 = -1 \times 2x$, so $-3 = -2x$,
so $x = \frac{-3}{-2}$. Hence the solution is $x = \frac{3}{2}$.
(j) Find x if $x = \frac{3}{2} - \frac{-3}{-2} = \frac{3}{2} - \frac{3}{2} = \frac{3}{2} - \frac{3}{2} = \frac{9}{2}$.
Hence the solution is $x = 0$.
(k) $x = \frac{-1}{-5}$; $\frac{-4}{-5} = \frac{-1}{-5} \times \frac{-4}{-3} = \frac{1}{5} \times \frac{4}{3} = \frac{4}{15}$.
Hence the solution is $x = 0$.
(k) $x = \frac{-1}{-5}$; $\frac{-4}{-4} = \frac{-1}{-5} \times \frac{-4}{-3} = \frac{1}{5} \times \frac{4}{3} = \frac{4}{15}$.
Hence the solution is $x = \frac{4}{15}$.
(a) Now $\sqrt{72} = \sqrt{2 \times 35} = \sqrt{2 \times 2 \times 18} = \sqrt{2 \times 2 \times 2 \times 9}$
 $= \sqrt{2 \times 2 \times 2 \times 3 \times 3}$.
Then $\sqrt{72} = 2 \times 3 \times \sqrt{2}$. Hence the solution is $6\sqrt{2}$.
(b) $(\sqrt{4} + \sqrt{3})(\sqrt{4} - \sqrt{6}) = \sqrt{4} \times \sqrt{4} + \sqrt{4} \times (-\sqrt{6}) + \sqrt{3} \times \sqrt{4} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= \sqrt{4 \times 4} - \sqrt{4 \times 6} + \sqrt{3 \times 4} - \sqrt{3 \times 6} + \sqrt{3} \times (-\sqrt{6})$
 $= 4 - 2\sqrt{6} + 2\sqrt{3} - 3\sqrt{2}$.
Itere the solution is $x = 1$.
(b) $\sqrt{3 x} = 2\sqrt{5}$. Now $\sqrt{32} = \sqrt{4 \times 4 \times 2} = \sqrt{6}$.
Us $0 = -4x + 5 = -1$, so $-4x = 1 - 5$, so $-4x = -4$, so $-\frac{4}{3}$.
Hence the solution is $x = -\frac{3}{2}$.
(c) $1 - 2 + 4x + 4$, so $-2 - 4 = 4x$, so $-6 + 4x$.
Hence the solution is $x = -\frac{3}{2}$.

(k)
$$x = \frac{-3}{-1} \div \frac{2}{5} = \frac{-3}{-1} \times \frac{5}{2} = \frac{3}{1} \times \frac{5}{2} = \frac{15}{2}$$
.
Hence the solution is $x = \frac{15}{2}$.