1) Circle the irrational numbers.

$.3, \sqrt{10}, \sqrt{9}, 2\sqrt{3}, \pi$

2) Simplify

a) $\sqrt{9}$

b) $\sqrt{27}$

c) $2\sqrt{18}$

d) $\sqrt{2\frac{1}{4}}$

e) $\sqrt{x^3}$

3) Simplify

a) $4\sqrt{3} - 2\sqrt{3} + 5\sqrt{3}$

b) $4\sqrt{3} + 3\sqrt{5} - \sqrt{3} + 2\sqrt{5}$

c) $\sqrt{2} + \sqrt{32}$

d) $\sqrt{12} + 2\sqrt{48}$

e) $3\sqrt{24} - 5\sqrt{54}$

4) Simplify

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

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

c) $3\sqrt{6} \times 2$

d) $2\sqrt{6} \times \sqrt{3}$

e) $\left(2\sqrt{3}\right)^2$

f) $\sqrt{8} \div \sqrt{2}$

g) $\dfrac{5\sqrt{3}}{10\sqrt{6}}$

5) Expand and simplify
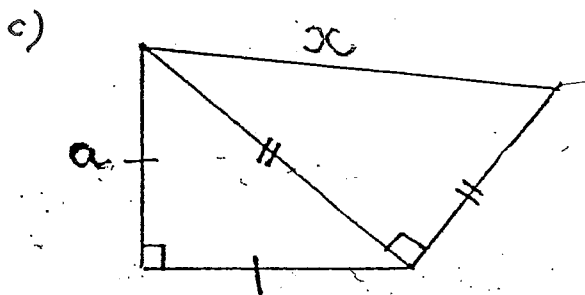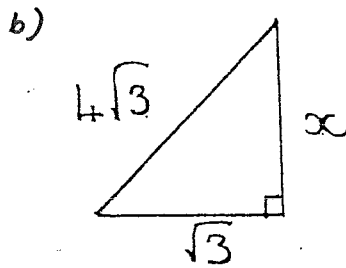
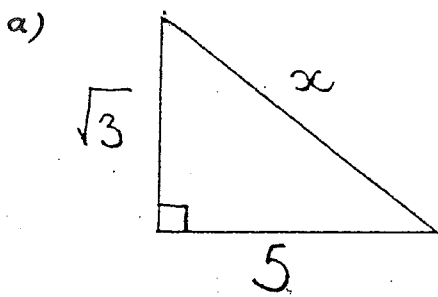a) $\sqrt{3}\left(\sqrt{2} + 1\right)$

b) $\sqrt{3}\left(\sqrt{3} - 1\right)$

c) $2\sqrt{5}\left(1 - 3\sqrt{5}\right)$

d) $\sqrt{6}\left(2\sqrt{3} + 2\right)$

e) $\left(\sqrt{3} + 4\right)\left(\sqrt{3} - 2\right)$

f) $\left(2\sqrt{7} + 1\right)^2$

6) Find x in simplest form

a)

$\sqrt{3}$ ... x ... 5

b)

$4\sqrt{3}$ ... x ... $\sqrt{3}$

c)

x ... a

7) Find x if

$$\sqrt{18} + \sqrt{32} = \sqrt{x}$$

8) Rationalise the denomin-ator

a) $\dfrac{6}{\sqrt{3}}$

b) $\dfrac{2}{\sqrt{3}-1}$

c) $\dfrac{\sqrt{5}-1}{\sqrt{5}+1}$

9. Simplify

$$\dfrac{3}{\sqrt{3}+1} - \dfrac{1}{\sqrt{5}-1}$$

Circle the irrational numbers

3 $\boxed{\sqrt{10}}$, $\sqrt{9}$, $\boxed{2\sqrt{3}}$, $\boxed{\sqrt{11}}$ (1m)

Simplify

a) $\sqrt{9}$ 3 ✓   e) $\sqrt{x^3}$ $x\sqrt{x}$ ✓

b) $\sqrt{27}$ $3\sqrt{3}$ ✓

c) $2\sqrt{18}$ $6\sqrt{2}$ ✓

d) $\sqrt{2\frac{1}{4}}$ $1\frac{1}{2}$ ✓   2.25   (5m)

Simplify

$4\sqrt{3} - 2\sqrt{3} + 5\sqrt{3}$ ✓✓
$= 7\sqrt{3}$

$4\sqrt{3} + 3\sqrt{5} - \sqrt{3} + 2\sqrt{5}$ ✓✓
$3\sqrt{3} + 5\sqrt{5}$

$\sqrt{2} + \sqrt{32}$
$= \sqrt{2} + 4\sqrt{2}$
$= 5\sqrt{2}$ ✓✓

$\sqrt{12} + 2\sqrt{48}$
$2\sqrt{3} + 8\sqrt{3}$ ✓✓
$= 10\sqrt{3}$

$3\sqrt{24} - 5\sqrt{54}$
$6\sqrt{6} - 15\sqrt{6}$ ✓✓
$= -9\sqrt{6}$ $\boxed{16}$ (10m)

4) Simplify $\boxed{\frac{54}{55}}$

a) $\sqrt{3} \times \sqrt{2}$ $\sqrt{6}$ ✓

b) $2\sqrt{5} \times 3\sqrt{2}$ $6\sqrt{10}$ ✓

c) $3\sqrt{6} \times 2\cdot 6\sqrt{6}$ ✓

d) $2\sqrt{6} \times \sqrt{3}$ $2\sqrt{18}$ — simplify
$= 6\sqrt{2}$ ✓

e) $(2\sqrt{3})^2 \div 2$ ✓

f) $\sqrt{8} \div \sqrt{2}$ $= \sqrt{4} = 2$ ✓

g) $\frac{5\sqrt{3}}{10\sqrt{6}}$ $\frac{1}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{4}$ ✓   (7m)
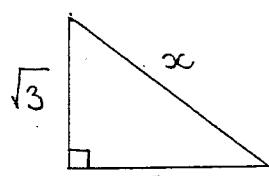
5) Expand and simplify

a) $\sqrt{3}(\sqrt{2} + 1) = \sqrt{6} + \sqrt{3}$ ✓✓

b) $\sqrt{3}(\sqrt{3} - 1) = 3 - \sqrt{3}$ ✓✓

c) $2\sqrt{5}(1 - 3\sqrt{5})$ $2\sqrt{5} - 6 \times 5$ ✓✓
$2\sqrt{5} - 30$

d) $\sqrt{6}(2\sqrt{3} + 2)$ $2\sqrt{18} + 2\sqrt{6}$ ✓✓
$= 6\sqrt{2} + 2\sqrt{6}$

e) $(\sqrt{3} + 4)(\sqrt{3} - 2)$
$3 - 2\sqrt{3} + 4\sqrt{3} - 8$
$= 2\sqrt{3} - 5$ ✓✓

f) $(2\sqrt{7} + 1)^2$
$= 28 + 4\sqrt{7} + 1$
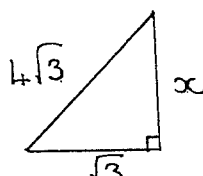$= 29 + 4\sqrt{7}$ $\boxed{19}$ (12m)

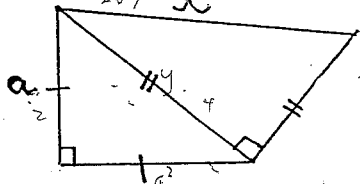Find x in simplest form $c^2 = a^2 + b^2$ (2m)(2m)

$c^2 = a^2 + b^2$
$x^2 = \sqrt{3}^2 + 5^2$
$= 3 + 25$
$x^2 = 28$
$x = \sqrt{28}$
$x = 2\sqrt{7}$

$c^2 = a^2 + b^2$
$(4\sqrt{3})^2 = \sqrt{3}^2 + x^2$
$48 = 3 + x^2$
$x^2 = 48 - 3$
$x^2 = 45$
$x = \sqrt{45}$
$x = 3\sqrt{5}$ ✓✓

$c^2 = a^2 + b^2$
$y^2 = a^2 + a^2$
$y^2 = 2a^2$
$y = a\sqrt{2}$

$x^2 = (a\sqrt{2})^2 + (a\sqrt{2})^2$
$x^2 = 2a^2 + 2a^2$
$x^2 = 4a^2$
$x = 2a$ ✓✓✓   (3m)

Find x if   (3m)
$\sqrt{18} + \sqrt{32} = \sqrt{x}$
$= 3\sqrt{2} + 4\sqrt{2} = \sqrt{x}$
$7\sqrt{2} = \sqrt{x}$
$x = (7\sqrt{2})^2$
$x = 98$ ✓✓

Rationalise the denominator
$\frac{6}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{6\sqrt{3}}{3} = 2\sqrt{3}$ ✓   (1m)

$\frac{12}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{2(\sqrt{3}+1)}{3-1}$
$= \frac{2(\sqrt{3}+1)}{2}$
$= \sqrt{3}+1$ (2m)

c) $\frac{\sqrt{5}-1}{\sqrt{5}+1} \times \frac{\sqrt{5}-1}{\sqrt{5}-1} = \frac{5 - 2\sqrt{5} + 1}{4}$ (3m)
$= \boxed{\frac{6 - 2\sqrt{5}}{4}}$ ✓✓

9. Simplify   (4m)
$\frac{3}{\sqrt{3}+1} - \frac{1}{\sqrt{5}-1}$

$\left(\frac{3}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}\right) - \left(\frac{1}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1}\right)$

$= \left(\frac{3\sqrt{3}-3}{3-1}\right) - \left(\frac{\sqrt{5}-1}{4}\right)$

$= \frac{3\sqrt{3}-3}{2} - \frac{\sqrt{5}-1}{4}$

$= \frac{6\sqrt{3}-6}{4} - \frac{\sqrt{5}-1}{4}$

$= \frac{6\sqrt{3}-7-\sqrt{5}}{4}$ $\boxed{\frac{19}{20}}$