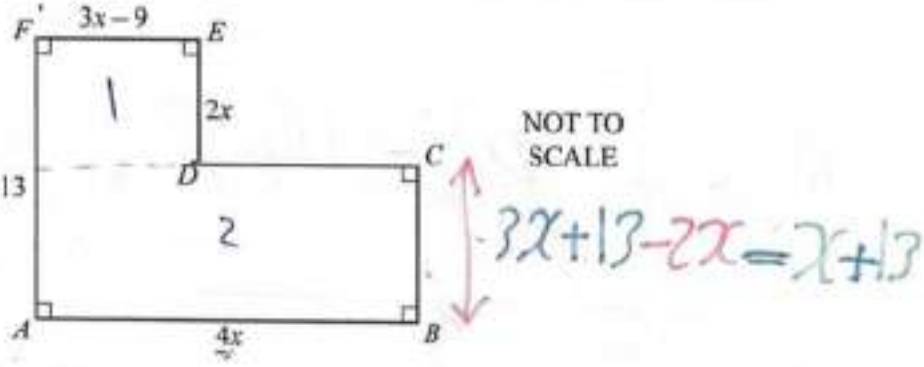
5 (a) The area of shape $ABCDEF$ is $24\,cm^2$.
All lengths are in centimetres.



(i) Show that $5x^2 + 17x - 12 = 0$.

Answer(a)(i)

$$\text{Area} = (x+13)(4x) + (2x)(3x-9) = 24$$

$$4x^2 + 52x + 6x^2 - 18x = 24$$

$$10x^2 + 34x - 24 = 0$$

$$5x^2 + 17x - 12 = 0$$

[3]

(ii) Solve, by factorising, the equation $5x^2 + 17x - 12 = 0$.
You must show all your working.

$$(5x-3)(x+4) = 0$$

Answer(a)(ii) $x =$ ..... or $x =$ ..... [3]

$5x - 3 = 0 \quad 5x = 3 \quad x = \frac{3}{5}$

$x + 4 = 0 \quad x = -4$

(b) Solve the simultaneous equations.
You must show all your working.

$3x - 2y = 23$ (1)
$-4x - y = -5$ (2)

$12x - 8y = 92$ (1)×4
$-12x - 3y = -15$ (2)×3

$-11y = 77$

$y = \frac{77}{-11} = -7$

$3x = 23 + 2y$

$x = \frac{23+2y}{3} = \frac{23+2(-7)}{3}$

$x = 3$

Answer(b) $x =$ 3
$y =$ −7 [3]

(c) Solve the equation.

$$\frac{2(t+3)}{t} - \frac{t}{t+3} = 1$$

$$\frac{2(t+3)(t+3) - t^2}{t(t+3)} = 1$$

$2t^2 + 12t + 18 - t^2 = t(t+3)$

$2t^2 + 12t + 18 - t^2 = t^2 + 3t$

$t^2 + 12t + 18 - t^2 - 3t = 0$

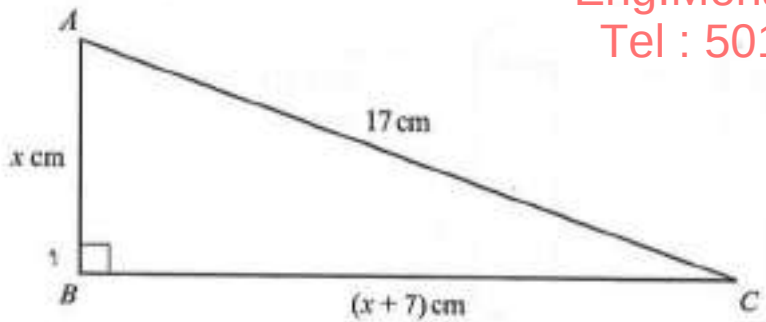
$9t = -18$

$t = \frac{-18}{9}$

$t = -2$

Answer(c) $t =$ −2 [5]

5 (a)



NOT TO SCALE

In the right-angled triangle ABC, $AB = x$ cm, $BC = (x + 7)$ cm and $AC = 17$ cm.

(i) Show that $x^2 + 7x - 120 = 0$.

Answer(a)(i)

$x^2 + (x+7)^2 = 17^2$

$x^2 + x^2 + 14x + 49 = 289$

$2x^2 + 14x - 240 = 0$

$x^2 + 7x - 120 = 0$ [3]

(ii) Factorise $x^2 + 7x - 120$.

$(x+15)(x-8)$

Answer(a)(ii) ..... [2]

(iii) Write down the solutions of $x^2 + 7x - 120 = 0$.

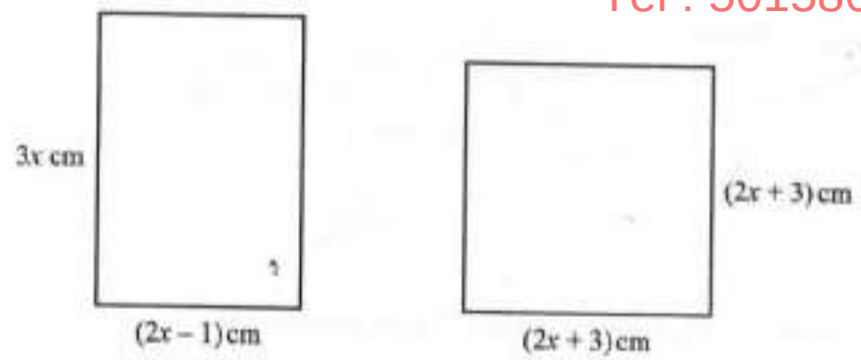
Answer(a)(iii) $x =$ 15 or $x =$ 8 [1]

(iv) Write down the length of BC.

$8 + 7 = 15$

Answer(a)(iv) $BC =$ ..... cm [1]

(b)



NOT TO SCALE

The rectangle and the square shown in the diagram above have the same area.

(i) Show that $2x^2 - 15x - 9 = 0$.

Answer(b)(i)

$(2x-1)(3x) = (2x+3)^2$

$6x^2 - 3x = 4x^2 + 12x + 9$

$6x^2 - 3x - 4x^2 - 12x - 9 = 0$

$2x^2 - 15x - 9 = 0$

[3]

(ii) Solve the equation $2x^2 - 15x - 9 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$= \dfrac{-(-15) \pm \sqrt{(-15)^2 - 4(2)(-9)}}{2(2)}$

$= \dfrac{15 \pm \sqrt{297}}{4}$

$x = \dfrac{15 + \sqrt{297}}{4}$

$x = \dfrac{15 - \sqrt{297}}{4}$

Answer(b)(ii) $x =$ −0.56 or $x =$ 8.06 [4]

(iii) Calculate the perimeter of the square.

$= 4(2x + 3)$

$= 8x + 12$

$8(8.06) + 12$

Answer(b)(iii) 76.5 cm [1]

5 (a) Solve $9 < 3n + 6 \leqslant 21$ for integer values of n.

$9 < 3n+6$ $\quad 3n+6 \leqslant 21$

$3 < 3n$ $\quad 3n \leqslant 15$

$1 < n$ $\quad n \leqslant 5$

Answer(a) 2, 3, 4, 5 [3]

(b) Factorise completely.

(i) $2x^2 + 10xy$

$2x(x+5y)$

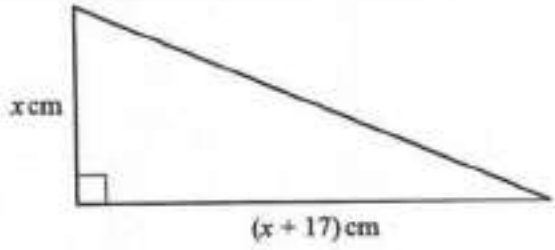
Answer(b)(i) ..... [2]

(ii) $3a^2 - 12b^2$

$3(a^2-4b^2) = 3(a-2b)(a+2b)$

Answer(b)(ii) ..... [3]

(c)



NOT TO SCALE

The area of this triangle is 84 cm^2.

(i) Show that $x^2 + 17x - 168 = 0$.

Answer (c)(i)

$\frac{1}{2}x(x+17) = 84$

$x(x+17) = 168$

$x^2+17x = 168$

$x^2+17x-168=0$

[2]

(ii) Factorise $x^2 + 17x - 168$.

$(x+24)(x-7)$

Answer(c)(ii) ..... [2]

(iii) Solve $x^2 + 17x - 168 = 0$.

Answer(c)(iii) $x =$ -24 or $x =$ 7 [1]

(d) Solve

$$\frac{15-x}{2} = 3-2x.$$

$15-x = 2(3-2x)$

$15-x = 6-4x$

$4x-x = 6-15$

$3x = -9 \quad x = \frac{-9}{3}$

Answer(d) $x =$ ..... 3 ..... [3]

(e) Solve $2x^2 - 5x - 6 = 0$.

Show all your working and give your answers correct to 2 decimal places.

$$= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-6)}}{2(2)}$$

$$= \frac{5 \pm \sqrt{73}}{4}$$

$$x = \frac{5+\sqrt{73}}{4}$$

$$x = \frac{5-\sqrt{73}}{4}$$

Answer(e) $x =$ ..... 0.89 ..... or $x =$ ..... 3.39 ..... [4]

3 (a) Expand the brackets and simplify.

$x(x+3)+4x(x-1)$

$x^2+3x+4x^2-4x$

$5x^2-x$

Answer(a) .....

(b) Simplify $(3x^3)^3$.

$27x^9$

Answer(b) .....

(c) Factorise the following completely.

(i) $7x^7+14x^{14}$

$7x^7(1+2x^7)$

Answer(c)(i) .....

(ii) $xy+xw+2ay+2aw$

$x(y+w)+2a(y+w)$

Answer(c)(ii) .....

$(x+2a)(y+w)$

(iii) $4x^2-49$

$(2x-7)(2x+7)$

Answer(c)(iii) .....

(d) Solve the equation.

$2x^2 + 5x + 1 = 0$

Show all your working and give your answers correct to 2 decimal places.

$$= \frac{-5 \pm \sqrt{5^2 - 4(2)(1)}}{2(2)}$$

$$= \frac{-5 \pm \sqrt{17}}{4}$$

$$x = \frac{-5 + \sqrt{17}}{4}$$

$$x = \frac{-5 - \sqrt{17}}{4}$$

Answer(d) $x =$ -0.22 or $x =$ -2.28 [4]

5 (a) (i) Factorise $3x^2+11x-4$.

$(3x-1)(x+4)$

.....[2]

(ii) Solve the equation $3x^2+11x-4=0$.

$3x-1=0 \quad 3x=1 \quad x=\frac{1}{3}$

$x+4=0 \quad x=-4$

$x =$ ..... or $x =$ .....[1]

(b) (i) Show that $\frac{2}{2x+11}-\frac{1}{x-4}=\frac{1}{2}$ simplifies to $2x^2+3x-6=0$.

$\frac{2(x-4)-(2x+11)}{(2x+11)(x-4)}=\frac{1}{2}$

$2[2x-8-2x-11]=2x^2-8x+11x-44$

$-38=2x^2+3x-44$

$2x^2+3x-6=0$

[4]

(ii) Solve the equation $2x^2+3x-6=0$.
You must show all your working and give your answers correct to 2 decimal places.

$=\frac{-3\pm\sqrt{3^2-4(2)(-6)}}{2(2)}$

$=\frac{-3\pm\sqrt{57}}{4}$

$x=\frac{-3+\sqrt{57}}{4}=1.14$

$x=\frac{-3-\sqrt{57}}{4}=-2.64$

7 (a) Solve the simultaneous equations.
You must show all your working.

$2x+3y=11$
$3x-5y=-50$

eq1
eq2

$6x+9y=33$ eq1 ×3
$-\ 6x-10y=-100$ eq2 ×2
$19y=133$

$y=\frac{133}{19}=7$

$x=\frac{11-3y}{2}$

$x=\frac{11-3(7)}{2}=-5$

$x=$ −5
$y=$ 7 [4]

(b) $x^2-12x+a=(x+b)^2$

Find the value of a and the value of b.

$x^2-12x+a=(x+b)^2$

$x^2-12x+a=x^2+2bx+b^2$

$-12=2b$ $b=-6$ $a=b^2$ $a=36$

$a=$ 36
$b=$ −6 [3]

(c) Write as a single fraction in its simplest form.

$\frac{x}{2x-5}+\frac{3x+2}{x-1}$

$=\frac{x(x-1)+(3x+2)(2x-5)}{(2x-5)(x-1)}$ $=\frac{7x^2-12x-10}{(2x-5)(x-1)}$

$=\frac{x^2-x+6x^2-15x+4x-10}{(2x-5)(x-1)}$