



1 Factorise  $2x^2 + 7x + 3$

(2 marks)

Look for two numbers that multiply to  $2 \times 3 = 6$  and add to 7:  
they are 6 and 1

Split the middle term

$$2x^2 + 6x + x + 3 = 2x(x + 3) + 1(x + 3)$$

Both groups now contain the whole factor  $(x + 3)$ . Taking out that shared factor leaves  $2x + 1$ , giving the two brackets below

Factorise:  $(2x + 1)(x + 3)$

Check by expanding

$$2x^2 + 6x + x + 3 = 2x^2 + 7x + 3, \text{ correct}$$

$$(2x + 1)(x + 3)$$

2 Factorise  $2x^2 + 5x - 3$

(2 marks)

Two numbers that multiply to  $-6$  and add to 5: 6 and  $-1$

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

Factorise in pairs

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

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

3 Factorise  $3x^2 - 10x + 8$

(2 marks)

Look for two numbers that multiply to  $3 \times 8 = 24$  and add to  $-10$ : they are  $-6$  and  $-4$

Split the middle term

$$3x^2 - 6x - 4x + 8 = 3x(x - 2) - 4(x - 2)$$

Factorise:  $(3x - 4)(x - 2)$

Check by expanding

$$3x^2 - 6x - 4x + 8 = 3x^2 - 10x + 8, \text{ correct}$$

$$(3x - 4)(x - 2)$$

4 Factorise  $4x^2 - 25$

(2 marks)

*Difference of two squares*

$$4x^2 = (2x)^2 \quad 25 = 5^2$$

$$(2x - 5)(2x + 5)$$

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

(3 marks)

Look for two numbers that multiply to  $2 \times (-12) = -24$  and add to 5: they are 8 and -3

*Split the middle term*

$$2x^2 + 8x - 3x - 12 = 2x(x + 4) - 3(x + 4) = (2x - 3)(x + 4)$$

*Set each factor to zero*

$$2x - 3 = 0 \text{ gives } x = \frac{3}{2}, \text{ and } x + 4 = 0 \text{ gives } x = -4$$

Check  $x = -4$ :  $2(16) - 20 - 12 = 32 - 32 = 0$ , correct

$$x = \frac{3}{2}, x = -4$$

6 Factorise fully  $18x^2 - 50$

(3 marks)

*Take out the common factor 2*

$$18x^2 - 50 = 2(9x^2 - 25)$$

*Difference of two squares*

$$2(3x - 5)(3x + 5)$$

7 Solve  $3x^2 - 11x + 6 = 0$

(3 marks)

Look for two numbers that multiply to  $3 \times 6 = 18$  and add to  $-11$ :  
they are  $-9$  and  $-2$

Split the middle term

$$3x^2 - 9x - 2x + 6 = 3x(x - 3) - 2(x - 3) = (3x - 2)(x - 3)$$

Set each factor to zero

$$3x - 2 = 0 \text{ gives } x = \frac{2}{3}, \text{ and } x - 3 = 0 \text{ gives } x = 3$$

Check  $x = 3$ :  $3(9) - 33 + 6 = 27 - 27 = 0$ , correct

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

8 Solve  $3x^2 = 5x + 2$

(3 marks)

$$\begin{array}{rcl} & 3x^2 & = 5x + 2 \\ -5x - 2 & 3x^2 - 5x - 2 & = 0 \end{array}$$

Two numbers with product  $-6$  and sum  $-5$ :  $-6$  and  $1$

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

$$3x(x - 2) + 1(x - 2) = 0$$

$$(3x + 1)(x - 2) = 0$$

$$x = -\frac{1}{3} \text{ or } x = 2$$

9 Solve  $5x^2 + 13x - 6 = 0$

(3 marks)

Look for two numbers that multiply to  $5 \times (-6) = -30$  and add to  $13$ : they are  $15$  and  $-2$

Split the middle term

$$5x^2 + 15x - 2x - 6 = 5x(x + 3) - 2(x + 3) = (5x - 2)(x + 3)$$

Set each factor to zero

$$5x - 2 = 0 \text{ gives } x = \frac{2}{5}, \text{ and } x + 3 = 0 \text{ gives } x = -3$$

Check  $x = -3$ :  $5(9) - 39 - 6 = 45 - 45 = 0$ , correct

$$x = \frac{2}{5}, x = -3$$

10

Simplify fully  $\frac{2x^2 + 5x - 3}{4x^2 - 1}$ 

(3 marks)

Factorise the top

$$2x^2 + 5x - 3 = (2x - 1)(x + 3)$$

Factorise the bottom (difference of two squares)

$$4x^2 - 1 = (2x - 1)(2x + 1)$$

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

Cancel  $(2x - 1)$ 

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

11

Factorise  $6x^2 - 7x - 20$ 

(3 marks)

Look for two numbers that multiply to  $6 \times (-20) = -120$  and add to  $-7$ : they are  $-15$  and  $8$

Split the middle term

$$6x^2 - 15x + 8x - 20 = 3x(2x - 5) + 4(2x - 5)$$

Factorise:  $(3x + 4)(2x - 5)$ 

Check by expanding

$$6x^2 - 15x + 8x - 20 = 6x^2 - 7x - 20, \text{ correct}$$

|                    |
|--------------------|
| $(3x + 4)(2x - 5)$ |
|--------------------|

12

The area of a rectangle is  $(6x^2 + 11x - 10) \text{ cm}^2$ . One side of the rectangle is  $(3x - 2) \text{ cm}$ .

- Find an expression, in terms of  $x$ , for the length of the other side.
- The perimeter of the rectangle is 26 cm. Work out the value of  $x$ .

(5 marks)

a)

Two numbers with product -60 and sum 11: 15 and -4

$$= 6x^2 + 15x - 4x - 10$$

$$= 3x(2x + 5) - 2(2x + 5)$$

$$= (3x - 2)(2x + 5)$$

$$\text{other side} = (2x + 5) \text{ cm}$$

b)

$$\text{perimeter} = 2(3x - 2) + 2(2x + 5)$$

$$= 10x + 6$$

$$10x + 6 = 26$$

-6

$$10x = 20$$

-6

$$x = 2$$

13

Solve  $6x^2 + x - 12 = 0$

You must show clear algebraic working.

(4 marks)

Look for two numbers that multiply to  $6 \times (-12) = -72$  and add to 1: they are 9 and -8

Split the middle term

$$6x^2 + 9x - 8x - 12 = 3x(2x + 3) - 4(2x + 3) = (3x - 4)(2x + 3)$$

Set each factor to zero

$$3x - 4 = 0 \text{ gives } x = \frac{4}{3}, \text{ and } 2x + 3 = 0 \text{ gives } x = -\frac{3}{2}$$

$$\text{Check } x = \frac{4}{3}: 6\left(\frac{16}{9}\right) + \frac{4}{3} - 12 = \frac{32}{3} + \frac{4}{3} - \frac{36}{3} = 0, \text{ correct}$$

$$x = \frac{4}{3}, x = -\frac{3}{2}$$

14

Factorise  $12x^2 + x - 6$ 

(3 marks)

Two numbers that multiply to -72 and add to 1: 9 and -8

$$= 12x^2 + 9x - 8x - 6$$

$$= 3x(4x + 3) - 2(4x + 3)$$

$$(4x + 3)(3x - 2)$$