Starter

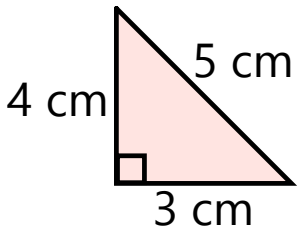
1) Write down the formula for the volume of a cylinder

$V = \pi r^2 \times h$

2) Round 6.6112 to 3 significant figures

6.61

3) Find the area of the triangle:



$A = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 3 \times 4$

$= 6\ cm^2$

Examples

Simplify the following:

1) $6 \times w$

$= 6w$

2) $8q \times p$

$= 8 \times q \times p$

$= 8qp$

3) $4a \times 3b$

$= 4 \times a \times 3 \times b$

$= 12ab$

4) $2 \times c$

$= 2c$

5) $14d \times e$

$= 14de$

6) $9f \times 7g$

$= 63fg$

7) $s \div d$

$= \frac{s}{d}$

8) $4b \div 8c$

$= \frac{4b}{8c} = \frac{b}{2c}$

9) $q^3 \times q^4$

$= q \times q \times q \times q \times q \times q \times q$

$= q^7$

Simplify the following.

1) $4r + 6r$ = 10r

2) $2a + 3b - a + 9b$ a + 12b

3) $q \times q \times q \times q$ q^4

4) $d \times d \times c \times c \times c$ d^2c^3

5) $5w^2 \times 2x^7$ $10w^2x^7$

6) $4s \times 8t$ 32st

7) $3x^2 + 7x^2$ $10x^2$

8) $3m + 13m - 8$ 16m − 8

9) $10d + 2d - 4d$ 8d

10) $4a \times 8b \times 2$ 64ab

11) $4 \times a + 8$ 4a + 8

12) $8 - 3 \times w$ 8 − 3w

13) $14s - 4 \times 2s$ 14s − 8s = 6s

14) $6x^2 - 3 \times x$ $6x^2 - 3x$

Simplify the following.

1) $10r$

2) $a + 12b$

3) q^4

4) $d^2 \times c^2$

5) $10w^2x^7$

6) $32st$

7) $10x^2$

8) $16m - 8$

9) $8d$

10) $32ab$

11) $4a + 8$

12) $8 - 3w$

13) $6s$

14) $6x^2 - 3x$

ANSWERS

Simplify:

$$5 - 3t + 13t$$

$5 + 10t$

Simplify:

$$12 \times q + 8 \times r$$

Simplify:

$$2b \times 3c \times 8$$

Simplify:

$$17 - 7 \times d + 10$$

$17 - 7d + 10$

$27 - 7d$

Simplify:

$$6e + 3e - 9e^2$$

It is possible to 'tidy up' expressions by collecting like terms.

Examples

1) $3x + 7x$

$= 10x$

2) $2f + 5f + f$

$= 8f$

3) $2p + 1 + 4p - 5p - 6$

$= 2p + 4p - 5p + 1 - 6$

$= p - 5$

4) $3w + 5w - 3p + 2$

$= 3w - 3p + 2$

5) $10q + 4r - 6q - r$

$= 10q - 6q + 4r - r$

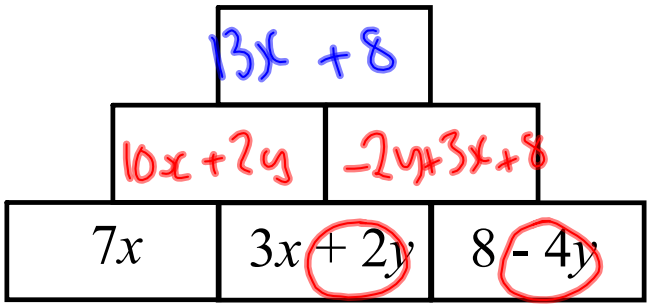
$= 4q + 3r$

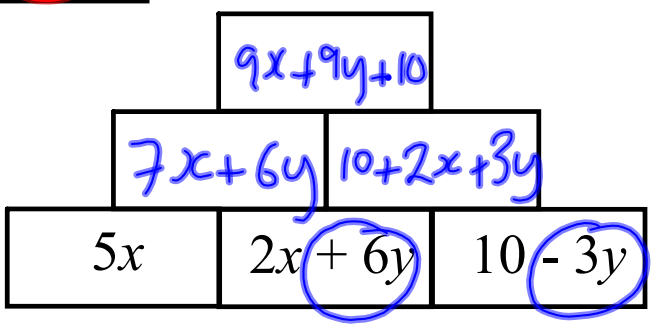
6) $10b^2 + 3c^2 + 6b^2 - c^2$

$= 10b^2 + 6b^2 + 3c^2 - c^2$

$= 16b^2 + 2c^2$

Fill in the boxes by adding the 2 boxes underneath





Examples

1) $11ab + 6ba - 2ab$

ba is the same as ab

$= 11ab + 6ab - 2ab$

$= 15ab$

2) $5a^2 + 4a^3 - 3a^2 + 6ab$

$= 5a^2 - 3a^2 + 4a^3 + 6ab$

$= 2a^2 + 4a^3 + 6ab$

3) $4ab^2c + 5abc^2 - 3ab^2c + 2abc^2$

$= 4ab^2c - 3ab^2c + 5abc^2 + 2abc^2$

$= ab^2c + 7abc^2$

1) $4s + 1 - 3s - 5$ = 5-4

2) $3a + 2b + a + 7b$ 4a + 9b

3) $5g + 8g + 1 - 3g$ 10g+1

4) $x^2 + 3x^2$ 4x²

5) $3y^2 - 2y^2$ y²

6) $20b + 18b + 2b$ 40b

7) $5a^2 - 4 + a^2$

8) $7v^2 - 6v^2 + 10v^2$

9) $2a^2 + 5b^2 + a^2 - b^2$

10) $4l^2 - 2m^2 - 7l^2 + 8m^2$

11) $3xyz^2 + 5xyz^2 + 7x^2yz$

12) $3abc^2 + 3ab^2c + 3a^2b^2c$

1) $s - 4$

2) $4a + 9b$

3) $10g + 1$

4) $4x^2$

5) y^2

6) $40b$

7) $6a^2 - 4$

8) $11v^2$

9) $3a^2 + 4b^2$

10) $-3l^2 + 6m^2$

11) $8xyz^2 + 7x^2yz$

12) $3abc^2 + 3ab^2c + 3a^2b^2c$

ANSWERS

Multiplying Out Brackets

Multiply each term by the number directly outside the bracket - take care if it's negative.

e.g. 1) $3(g + 4) = 3g + 12$

2) $2(h^2 + 4h - 1) = 2h^2 + 8h - 2$

3) $-3(2j + 1) = -6j - 3$

4) $-2(p - 10) = -2p + 20$

Multiply out the brackets:

1) $4(T - 2)$ $4T - 8$

2) $3(2g + 11) = 6g + 33$

3) $10(5u - 1) = 50u - 10$

4) $-3(t - 4) = -3t + 12$

5) $-2(1 - 2y) = -2 + 4y$

6) $-u(3 + u) = -3u - u^2$

Multiply out the brackets:

1) 4T - 8

2) 6g + 33

3) 50u - 10

4) -3t +12

5) -2 + 4y

6) -u3 - u²

Multiply out the brackets and simplify the expressions:

1) 3(y + 2) + 4

2) 6(3r - 2) + 4r

3) 2 + 3(2y - 1)

4) 4 - (T + 1)

5) 2 + 3(7y - 4) - 10y

6) 2(y + 3) - 2(3y + 4)

$3(y+2)+4$
$= 3y+6+4$
$= 3y+10$

Multiply out the brackets and simplify the expressions:

1) 3y + 10

2) 22r - 12

3) 6y - 1

4) 3 - T

5) 11y - 10

6) - 4y - 2

Starter

1) Round 7629 to 2 significant figures

7600

2) Write down the formula for the volume of a cylinder

$V = \pi r^2 h$

3) Simplify 3 + 2(h - 1)

$3 + 2h - 2 = 2h + 1$

4) Expand the brackets and simplify: 3g(g - 1)

$3g^2 - 3g$

Simplify the following:

m x m m^2

5 x m $5m$

-4 x m $-4m$

-3 x 3 -9

2 x -2 -4

- 4 x - 4 16

Multiplying Out Double Brackets

Multiply each term in the first bracket by each term in the second bracket.

e.g. 1) $(m + 3)(m + 7)$

$= m^2 + 7m + 3m + 21$

$= m^2 + 10m + 21$

2) $(y + 1)(y - 2)$

$= y^2 - 2y + y - 2$

$= y^2 - y - 2$

3) $(p - 3)(p - 5)$

$= p^2 - 5p - 3p + 15$

$= p^2 - 8p + 15$

Multiply out the brackets and simplify:

1) $(c+5)(c+6)$ **2)** $(y+4)(y+2)$ **3)** $(y+5)(y+2)$

4) $(c+2)(c-7)$ **5)** $(a-4)(a-4)$ **6)** $(x-6)(x+1)$

7) $(b-2)(b+9)$ **8)** $(p-10)(p+2)$ **9)** $(x-6)(x-5)$

10) $(b-5)(b-3)$ **11)** $(s-8)(s-5)$ **12)** $(x+2)(x+3)$

13) $(t-5)(t+4)$ **14)** $(t-5)(t+4)$ **15)** $(a+3)(a-7)$

16) $(t+4)(t+4)$ **17)** $(x-4)(x+2)$ **18)** $(a+6)(a-6)$

Multiply out the brackets and simplify:

1) $c^2+11c+30$ **2)** y^2+6y+8 **3)** $y^2+7y+10$

4) $c^2-5c-14$ **5)** $a^2-8a+16$ **6)** x^2-5x-6

7) $b^2+7b-18$ **8)** $p^2-8p-20$ **9)** $x^2-11x+30$

10) $b^2-8b+15$ **11)** $s^2-13s+40$ **12)** x^2+5x+6

13) t^2-t-20 **14)** **15)** $a^2-4a-21$

16) $t^2+8t+16$ **17)** x^2-2x-8 **18)** a^2-36

Starter

Multiply out the brackets:

1) $3g(1 + 2g - b)$

$= 3g + 6g^2 - 3gb$

2) $(j + 3)(j + 10)$

$= j^2 + 10j + 3j + 30$

$= j^2 + 13j + 30$

3) $(y - 4)(y - 5)$

$= y^2 - 5y - 4y + 20$

$= y^2 - 9y + 20$

4) $(2m - 1)(m + 5)$

$= 2m^2 + 10m - m - 5$

$= 2m^2 + 9m - 5$

5) $(3g - 2)(5g + 1)$

$= 15g^2 + 3g - 10g - 2$

$= 15g^2 - 7g - 2$

6) $(q - 1)(q^2 + q - 4)$

$= q^3 + q^2 - 4q - q^2 - q + 4$

$= q^3 - 5q + 4$

7) $(b - 1)^2$

$= (b - 1)(b - 1)$

$= b^2 - b - b + 1$

$= b^2 - 2b + 1$

Challenge:

Multiply out the brackets and simplify:

(a) $(x + 5)(2x^2 + 4x + 9)$

(b) $(x - 3)(5x^2 + x + 6)$

(c) $(x - 2)(6x^2 - 5x + 7)$

(d) $(x + 7)(3x^2 + 9x - 2)$

(e) $(x - 4)(5x^2 - x - 8)$

(f) $(x + 1)(7x^2 - 2x + 11)$

(g) $(2x + 1)(3x^2 + 4x + 1)$

(h) $(3x + 4)(x^2 - 11x + 2)$

(i) $(5x - 2)(2x^2 + 3x - 7)$

(j) $(4x - 3)(3x^2 - 5x - 4)$

(a) $2x^3 + 14x^2 + 29x + 45$

(b) $5x^3 - 14x^2 + 3x - 18$

(c) $6x^3 - 17x^2 + 17x - 14$

(d) $3x^3 + 30x^2 + 61x - 14$

(e) $5x^3 - 21x^2 - 4x + 32$

(f) $7x^3 + 5x^2 + 9x + 11$

(g) $6x^3 + 11x^2 + 6x + 1$

(h) $3x^3 - 29x^2 - 38x + 8$

(i) $10x^3 + 11x^2 - 41x + 14$

(j) $12x^3 - 29x^2 - x + 12$

a $x^2 + 3x - 10$

b $y^2 + 3y - 4$

c $a^2 + a - 6$

d $b^2 + b - 2$

e $m^2 - 2m - 15$

f $-n^2 - 2n + 3$

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

h $5a^2 - 19a - 4$

i $3u^2 - 2u - 8$

j $9x^2 - 25$

k $14a^2 - 12a - 2$

l $20h^2 - 7h - 6$

m $x^2 + 3xy + 2y^2$

n $x^2 - xy - 2y^2$

o $x^2 + xy - 2y^2$

p $x^2 - 3xy + 2y^2$

q $3a^2 + 7ab + 4b^2$

r $2p^2 - pq - 2q^2$

s $2x^2 + 9x + 10$

t $a^2 - 3a + 2$

u $-2b^2 + 7b + 15$

v $p^2 - q^2$

w $-9y^2 + 8y + 1$

x $20k^2 - 9k + 1$

4. a $x^3 + 2x^2 + x + 2$ b $x^3 + 3x^2 + 5x + 15$
c $x^3 - 2x^2 + 3x - 6$ d $2x^3 - 8x^2 + 3x - 12$
e $2x^3 + x^2 - 4x - 2$ f $10x^3 - 6x^2 + 15x - 9$
g $x^4 + 7x^2 + 12$ h $x^4 + 3x^2 - 10$
i $x^3 + x^2y + xy^2 + y^3$ j $2x^3 - x^2y + 2xy^2 - y^3$
k $3x^3 + 2x^2y - 2xy^2 - 2y^3$ l $x^4 - y^4$

Starter

Multiply out the brackets and simplify:

1) (n + 1)(n + 3)

$n^2 + 3n + n + 3$

$n^2 + 4n + 3$

2) (g - 4)(g + 3)

$g^2 + 3g - 4g - 12 = g^2 - g - 12$

3) (3t - 2)(t - 4)

$3t^2 - 12t - 2t + 8$

$= 3t^2 - 14t + 8$

4) (m - 3)(m + 10)

$m^2 + 10m - 3m - 30$

$m^2 + 7m - 30$

5) (3g - 4)(2g + 10)

$= 6g^2 + 30g - 8g - 40$

$= 6g^2 + 22g - 40$

6) (p - 1)(p² - 3p + 2)

$= p^3 - 3p^2 + 2p - p^2 + 3p - 2$

$= p^3 - 4p^2 + 5p - 2$

Today's Learning:

To factorise by taking out a common factor.

Factorising

Factorising means writing an expression as a product of its factors. It usually means **introduce brackets**.

e.g. Factorise by taking out a common factor:

1) $10h - 25$

$= 5(2h - 5)$

2) $14x^3 - 20x^2$

$= 2(7x^3 - 10x^2)$

$= 2x(7x^2 - 10x)$

$= 2x^2(7x - 10)$

3) $4e^3 - 10e^2 + 14e$

$= 2e(2e^2 - 5e + 7)$

Work through questions 1 - 7 on pages 17-18

Just the **first column** for each.

$ax + ay$
$= a(x + y)$

Starter

Multiply out the brackets and simplify:

1) $(y - 2)(y + 7)$

$= y^2 + 7y - 2y - 14$
$= y^2 + 5y - 14$

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

$= x^2 - 3x + 3x - 9 = x^2 - 9$

3) $(4r - 1)(r - 4)$

$= 4r^2 - 16r - r + 4$
$= 4r^2 - 17r + 4$

Spend some more time on Q6 and Q7 on page 18

$2ax + 6a$

$= 2a(x + 3)$

Multiply out the following:

1) (d + 3)(d - 3)

$d^2 - 3d + 3d - 9$

$= d^2 - 9$

2) (m + 5)(m - 5)

$m^2 - 25$

3) (7 + y)(7 - y)

$49 - 7y + 7y - y^2$

$49 - y^2$

What do you notice?

$x^2 - 36$

$(x + 6)(x - 6)$

Starter

Multiply out the brackets:

1) $(u - 2)(u + 6)$

$= u^2 + 6u - 2u - 12$

$= u^2 + 4u - 12$

2) $(4t - 2)(2t + 1)$

$= 8t^2 + 4t - 4t - 2$

$= 8t^2 - 2$

3) $(e - 1)(3 - 4e)$

$= 3e - 4e^2 - 3 + 4e = -4e^2 + 7e - 3$

Difference of Two Squares

If you see 2 squared terms and one is negative, we can factorise using difference of two squares.

e.g. Factorise

a) $g^2 - 4$ **b)** $m^2 - r^2$ **c)** $4t^2 - 16y^2$

$= (g + 2)(g - 2)$ $(m + r)(m - r)$ $(2t + 4y)(2t - 4y)$

work on Q9 on page 18

Sometimes we can take out a common factor, then use difference of two squares.

e.g. 1) $3y^2 - 75$ **2)** $32 - 2y^2$

$= 3(y^2 - 25)$

$= 3(y + 5)(y - 5)$

$= 2(16 - y^2)$

$= 2(4 + y)(4 - y)$

work on Q10 on pg 18

Factorise by taking out a common factor:

$$4g^3 - 2g^2$$

Factorise using difference of two squares:

$$y^2 - 25$$

Starter

Factorise the following:

1) $6y^2 - 3y$

$= 3y(2y - 1)$

2) $g^2 - 16$

$(g + 4)(g - 4)$

3) $4h^2 - x^2$

$(2h + x)(2h - x)$

Multiply out the brackets and simplify:

1) $(p + 4)(p + 5)$ $= p^2 + 5p + 4p + 20 = p^2 + 9p + 20$

2) $(u - 4)(u - 2)$ $= u^2 - 2u - 4u + 8 = u^2 - 6u + 8$

3) $(p - 4)(p + 10)$ $= p^2 + 10p - 4p - 40 = p^2 + 6p - 40$

4) $(2T - 3)(T + 4)$ $= 2T^2 + 8T - 3T - 12 = 2T^2 + 5T - 12$

5) $(3e - 4)(2e + 9)$ $= 6e^2 + 27e - 8e - 36$
$= 6e^2 + 19e - 36$

6) $(2 - r)(r^2 - 3r + 5)$

$= 2r^2 - 6r + 10 - r^3 + 3r^2 - 5r$

$= -r^3 + 5r^2 - 11r + 10$

Trinomials

Trinomials are usually written $ax^2 + bx + c$.

Factorising Trinomials

e.g. Factorise $x^2 + 6x + 8$

4, 2
1, 8

What multiplies to make 8?

Which of those add to make 6?

$(x + 4)(x + 2)$

$x^2 + 2x + 4x + 8$

Factorising Trinomials

e.g. Factorise $x^2 + 7x + 10$

5, 2
1, 10

What multiplies to make 10?

Which of those add to make 7?

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

Factorising Trinomials

e.g. Factorise $x^2 + 11x + 30$

15, 2
5, 6
1, 30
3, 10

What multiplies to make 30?

Which of those add to make 11?

$(x + 5)(x + 6)$

Factorising Trinomials

x to make the **last** number, **+** to make the **middle** number

e.g. 1) $m^2 + 9m + 20$

$(m + 5)(m + 4)$

20
=
5, 4
10, 2
1, 20

2) $g^2 + 11g + 24$

$(g + 8)(g + 3)$

24
=
6, 4
1, 24
2, 12
8, 13

Factorise the following:

1) $m^2 + 7m + 12$ $(m+3)(m+4)$

2) $g^2 + 7g + 6$ $(g+1)(g+6)$

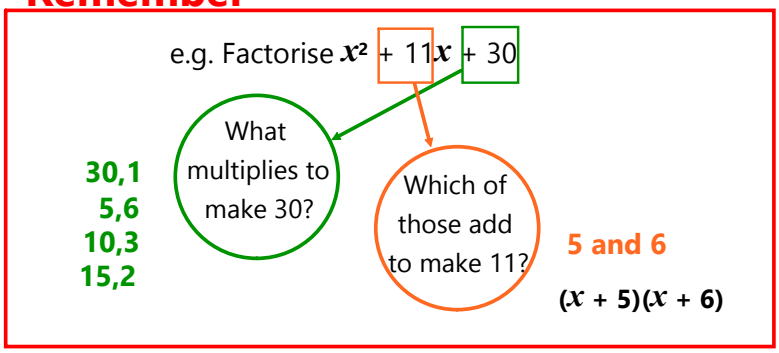
3) $p^2 + 12p + 35$ $(p+7)(p+5)$

4) $R^2 + 6R + 9$ $(R+3)(R+3)$ $(R+3)^2$

5) $n^2 + 10n + 24$ $(n+6)(n+4)$

Starter

Remember



Factorise:

1) $y^2 + 3y + 2$ $(y+2)(y+1)$ 2, 1

2) $u^2 + 11u + 10$ $(u+10)(u+1)$ 10 / 5, 2 / 10, 1

3) $p^2 + 10p + 16$ $(p+8)(p+2)$ 16 / 8, 2 / 4, 4 / 16, 1

3) $t^2 - 9t + 20$

$(t-5)(t-4)$

20
20, 1
10, 2
5, 4

4) $q^2 - 13q + 30$

$(q-3)(q-10)$

30
30, 1
15, 2
5, 6
3, 10

Factorise the following:

1) $m^2 - 8m + 12$ $(m-2)(m-6)$

2) $q^2 - 10q + 16$ $(q-2)(q-8)$

3) $f^2 - 10f + 9$ $(f-1)(f-9)$

4) $b^2 - 6b + 5$ $(b-5)(b-1)$

5) $a^2 - 12a + 32$ $(a-8)(a-4)$

5) $m^2 - 5m - 50$

$(m-10)(m+5)$

50
25, 2
50, 1
5, 10

5 - 10
= -5

+10 - 5
= 5

6) $R^2 + R - 20$

$(R-4)(R+5)$

20
20, 1
5, 4
2, 10

-4 + 5
= 1

work through **Q13** on page 19

$g^2 + 4g + 4$

$(g+2)(g+2)$

$f^2 - 10f + 16$

$(f-8)(f-2)$

$x^2 + 5x - 14$

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

Starter

Fill in the blanks:

1) $r^2 - 9r + 18$

$= (r - 6)(r - 3)$

18: 6,3 / 2,9 / 1,18

2) $y^2 - 4y - 12$

$= (y + 2)(y - 6)$

12: 3,4 / 2,6 / 12,1

3) $m^2 + 9m + 8$

$= (m + 1)(m + 8)$

8: 2,4 / 1,8

4) $a^2 + a - 30$

$= (a + 6)(a - 5)$

30: 6,5 / 15,2 / 1,30 / 3,10

Factorise the following:

1) $m^2 + 8m + 12 = (m+6)(m+2)$

2) $y^2 - 4y - 32 = (y+4)(y-8)$

3) $g^2 - 9g + 18 = (g-3)(g-6)$

4) $f^2 + 3f + 2 = (f+2)(f+1)$

5) $m^2 - 11m + 24 = (m-3)(m-8)$

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

24: 3,8 / 2,12 / 1,24 / 4,6

7) $3f^2 - 14f - 24$

$(3f \quad 2)(f \quad 12)$

$3f^2 \quad 36f \quad 2f \quad 24$

$(3f \quad 12)(f \quad 2)$

$3f^2 \quad 6f \quad 12f \quad 24$

$(3f + 4)(f - 6)$ ✓

$3f^2 - 18f + 4f \quad 24$

24
12, 1 2
6, 4
8, 3
1, 24

8) $6m^2 + 5m - 4$

$(6m \quad)(m \quad)$

$(3m + 4)(2m - 1)$ ✓

$3m \quad 8m \quad 4$

4
2, 2
4, 1

Starter

Fill in the blanks:

$$2x^2 + 1x - 3$$

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

$2x^2 \quad -2x \quad +3x \quad 3$

3
1, 3

For simple x^2 trinomials, practice Q13 page 19

$x^2 - 9$

$(x+3)(x-3)$

For trinomials with $2x^2$, $3x^2$, etc., practice Q16 page 20

$2x^2 + 4x - 8$

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

Factorising Expressions

To factorise any expression, look for

- A common factor
- Difference of two squares
- Trinomial to factorise

e.g. Factorise fully:

a) $3k^2 - 27$

$= 3(k^2 - 9)$

$= 3(k+3)(k-3)$

b) $4c^2 + 36c + 56$

$= 4(c^2 + 9c + 14)$

$= 4(c+7)(c+2)$

14

$7, 2$

$1, 14$

Factorising Expressions

To factorise any expression, look for

- A common factor
- Difference of two squares
- Trinomial to factorise

e.g. Factorise fully:

a) $3k^2 - 27$ **b)** $4c^2 + 36c + 56$

Starter

1) Factorise by taking out a common factor:

a) $3m^2 - 2m$ b) $4y^2 - 6y$ c) $2x^2y - 4yz$

$m(3m-2)$ $2y(2y-3)$ $2y(x^2-2z)$

2) Factorise using difference of two squares:

a) $y^2 - 16$ b) $4y^2 - 36$ c) $y^2 - z^2$

$(y+4)(y-4)$ $(2y+6)(2y-6)$ $(y+z)(y-z)$

3) Factorise the trinomials:

a) $y^2 - 3y - 18$ b) $y^2 + 2y - 8$ c) $2y^2 - 7y - 15$

$(y-6)(y+3)$ $(y+4)(y-2)$ $(2y+3)(y-5)$

8
2,4
8,1

15
3,5
1,15

Work through Q17 on page 20