Factorising Quadratics (a = 1)

Starter

1. **(Review of last lesson)**

Factorise these expressions: (a) $x^2 + 5x + 3x + 15$ (b) $3x^2 - 6x + 8x - 16$

Working: (a) $x^2 + 5x + 3x + 15 = x(x + 5) + 3(x + 5)$ ***factorise 1st/2nd & 3rd/4th****

$= (x + 5)(x + 3)$ ***take*** $(x + 5)$ ***out as a factor***

****Make sure the brackets are the same.***

(b) $3x^2 - 6x + 8x - 16 = 3x(x - 2) + 8(x - 2)$ ***factorise 1st/2nd & 3rd/4th****

$= (x - 2)(3x + 8)$ ***take*** $(x + 5)$ ***out as a factor***

****Make sure the brackets are the same.***

2. Find two whole numbers that:

(a) multiply to give 15 and add to give 8

(b) multiply to give -12 and add to give -4

Working: (a) 5 and 3 because $5 \times 3 = 15$ and $5 + 3 = 8$

(b) -6 and 2 because $-6 \times 2 = -12$ and $-6 + 2 = -4$

E.g. 1 Factorise $x^2 + 8x + 15$.

Working: $1 \times 15 = 15$ $\Rightarrow$ Multiply: $15 = 5 \times 3$

Add: $8 = 5 + 3$

Split $8x$ ***into*** $5x + 3x$***:*** $x^2 + 8x + 15 = x^2 + 5x + 3x + 15$

Factorise by grouping (same brackets): $= x(x + 5) + 3(x + 5)$

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

N.B. $8x$ could also be split into $3x + 5x$.

E.g. 2 Factorise $a^2 + 10a + 16$.

Working: $1 \times 16 = 16$ $\Rightarrow$ Multiply: $16 = 8 \times 2$

Add: $10 = 8 + 2$

Split $10a$ ***into*** $8a + 2a$***:*** $a^2 + 10a + 16 = a^2 + 8a + 2a + 16$

Factorise by grouping (same brackets): $= a(a + 8) + 2(a + 8)$

$= (a + 8)(a + 2)$

N.B. $10a$ could also be split into $2a + 8a$.

E.g. 3 Factorise $x^2 + 2x - 8$.

Working: $1 \times -8 = -8$ $\Rightarrow$ Multiply: $-8 = -2 \times 4$

Add: $2 = -2 + 4$

Split $2x$ ***into*** $-2x + 4x$***:*** $x^2 + 2x - 8 = x^2 - 2x + 4x - 8$

Factorise by grouping (same brackets): $= x(x - 2) + 4(x - 2)$

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

N.B. $2x$ could also be split into $4x - 2x$.

E.g. 4 Factorise $x^2 - 7x + 10$.

Working: $1 \times 10 = 10 \quad \Rightarrow$ Multiply: $10 = -2 \times -5$
Add: $-7 = -2 + -5$
Split $-7x$ ***into*** $-2x - 5x$***:*** $x^2 - 7x + 10 = x^2 - 2x - 5x + 10$
Factorise by grouping (same brackets): $= x(x - 2) - 5(x - 2)$
$= (x - 2)(x - 5)$
N.B. $-7x$ could also be split into $-5x - 2x$.

E.g. 5 Factorise $p^2 + 3p - 18$.

Working: $1 \times -18 = -18 \quad \Rightarrow$ Multiply: $-18 = 6 \times -3$
Add: $6 = 6 + -3$
Split $3p$ ***into*** $6p - 3p$***:*** $p^2 + 3p - 18 = p^2 + 6p - 3p - 18$
Factorise by grouping (same brackets): $= p(p + 6) - 3(p + 6)$
$= (p + 6)(p - 3)$
N.B. $3p$ could also be split into $-3p + 6p$.

If a factor can be taken out of the initial expression, do that at the beginning.

E.g. 6 Factorise $2z^2 + 16z + 24$.

Working: $2z^2 + 16z + 24 = 2(z^2 + 8z + 12)$
Now factorise $z^2 + 8z + 12$:
$1 \times 12 = 12 \quad \Rightarrow$ Multiply: $12 = 6 \times 2$
Add: $8 = 6 + 2$
Split $8z$ ***into*** $6z + 2z$***:*** $z^2 + 8z + 12 = z^2 + 6z + 2z + 12$
Factorise by grouping (same brackets): $= z(z + 6) + 2(z + 6)$
$= (z + 6)(z + 2)$
$\therefore 2z^2 + 16z + 24 = 2(z + 6)(z + 2)$
N.B. $8z$ could also be split into $2z + 6z$.

E.g. 7 Factorise $2x^2 - 4x - 30$.

Working: $2x^2 - 4x - 30 = 2(x^2 - 2x - 15)$
Now factorise $x^2 - 2x - 15$:
$1 \times -15 = -15 \quad \Rightarrow$ Multiply: $-15 = -5 \times 3$
Add: $-2 = -5 + 3$
Split $-2x$ ***into*** $-5x + 3x$***:*** $x^2 - 2x - 15 = x^2 - 5x + 3x - 15$
Factorise by grouping (same brackets): $= x(x - 5) + 3(x - 5)$
$= 2(x - 5)(x + 3)$
$\therefore 2x^2 - 4x - 30 = 2(x - 5)(x + 3)$
N.B. $-2x$ could also be split into $3x - 5x$.

Video: Factorising quadratics (a = 1)

Solutions to Starter and E.g.s

Exercise

9-1 class textbook:	p109 M4.8 Qu 1-30 (odd), 31, 32, 33-45 (odd)
A*-G class textbook:	p98 M4.7 Qu 1-30 (odd), 31, 32, 33-41 (odd)
9-1 homework book:	p39 M4.8 Qu 1-23
A*-G homework book:	p28 M4.7 Qu 1-20

Summary

Factorising quadratics

1. ***Multiply*** the coefficient of x^2 by the constant term
2. ***Find two numbers*** that ***multiply*** to get the number from 1. and ***add*** to get the coefficient of x
3. ***Separate into two terms*** the x term using the 2 numbers you found in 2.
4. ***Factorise*** the expression ***by grouping*** (make sure the ***brackets are the same***)

Homework book answers (only available during a lockdown)