

Section A - Revision

This section will help you revise previous learning which is required in this topic.

R1 I can multiply out a single bracket

1. Multiply out the brackets

- | | | |
|-------------------|-----------------------|-------------------|
| (a) $5(3x + 4)$ | (b) $7(2a - 5)$ | (c) $3(4y + 1)$ |
| (d) $2(7b - 5c)$ | (e) $3(2p + q)$ | (f) $8(r - 5)$ |
| (g) $3x(6x - 5)$ | (h) $2y(3y - 1)$ | (i) $5a(a - b)$ |
| (j) $-6(4x - 5)$ | (k) $-2(3t - u)$ | (l) $3(5 - 7x)$ |
| (m) $-9(6 - 2a)$ | (n) $2(3x - 5y + 7)$ | (o) $8(3 + 4c)$ |
| (p) $-3x(7x + 3)$ | (q) $2a(7b + 3c + 1)$ | (r) $-4x(1 - 2x)$ |

2. Multiply out the brackets and simplify.

- | | | |
|-------------------------------|-------------------------------------|--------------------------------------|
| (a) $\sqrt{5}(\sqrt{15} - 1)$ | (b) $\sqrt{2}(\sqrt{6} - \sqrt{3})$ | (c) $\sqrt{3}(\sqrt{12} + \sqrt{3})$ |
|-------------------------------|-------------------------------------|--------------------------------------|

3. Multiply out the brackets and simplify.

- | | | |
|---|------------------------------|---|
| (a) $x(x^5 + x^{-2})$ | (b) $r^3(r^{-5} + r^2)$ | (c) $a^{-5}(a + a^3)$ |
| (d) $2x^{\frac{1}{2}}(\sqrt{x} + 5x^{\frac{3}{2}})$ | (e) $3a^2(5a^{-1} + a^{-2})$ | (f) $a^{\frac{1}{2}}(\sqrt{a} - a^{-\frac{1}{2}})$ |
| (g) $t^{-3}(2t^{-3} - t^3)$ | (h) $5m^2(3m^2 + 4m^{-4})$ | (i) $k^{\frac{1}{3}}(k^{\frac{2}{3}} + k^{-\frac{1}{3}})$ |

Brackets and factorisation

R2 I can multiply out brackets and gather like terms

1. Multiply out the brackets and gather like terms

- (a) $3(x + 2) + 7$ (b) $5(3a - 1) + 7$ (c) $9 + 3(y + 5)$
(d) $7 + 3(2b - 5)$ (e) $3(2p + q) + 6q$ (f) $8(r - 5) - 3r$
(g) $3x(6x - 5) + 4x + 3$ (h) $2y(3y - 1) + 2y$ (i) $5(a - b) + 5b$

2. Multiply out the brackets

- (a) $7(2x + 3) + 2(4x + 1)$ (b) $2(3a - 7) - (2a + 5)$
(c) $6(6b - c) - 4(5b - 2c)$ (d) $4(3p + 2q) + 3(2p - q)$
(e) $3x(5x - 4) - 5x(4x + 3)$ (f) $2y(4y - 3) - 2y(2y - 3)$

R3 I can factorise using Common Factor

1. Factorise fully

- (a) $8x + 12y$ (b) $10a + 15b$ (c) $21p + 35q$
(d) $2mn + mp$ (e) $5rs + rt$ (f) $7xy + 2yz$
(g) $9pq - 12pr$ (h) $8xy - 20xz$ (i) $5p^2 - 15pq$

2. Factorise fully

- (a) $3x^2 - 2xy + 6x$ (b) $8x^2 - 16xt + 4xa$ (c) $3x^2 - 2xy$
(d) $25x^2 - 5x^2y$ (e) $10a^2 - 35a^2b$ (f) $24t - 3t^2r$
(g) $9x^3 - 15x^2 + 21x$ (h) $16ab^3 - 32ab + 48ab^2$ (i) $25ax^2 + 40x^3$

Brackets and factorisation

Section B - Assessment Standard Section

This section will help you practise for your Assessment Standard Test for Brackets and factorisation (Expressions and Formulae 1.2)

Practice Assessment Standard Questions

1. Multiply out the brackets

- | | | |
|----------------------|----------------------|------------------|
| (a) $t(3t - u)$ | (b) $(a + 3)(a + 4)$ | (c) $y(2y - z)$ |
| (d) $2b(3b - c)$ | (e) $(d + 2)(d + 5)$ | (f) $x(4x + 5)$ |
| (g) $(e + 7)(e + 3)$ | (h) $(g + 4)(g + 6)$ | (i) $5a(3a - 2)$ |

2. Factorise Fully

- | | | |
|----------------------|----------------------|-------------------|
| (a) $p^2 - 3p$ | (b) $x^2 + 5x + 6$ | (c) $x^2 + 5x$ |
| (d) $x^2 - 25$ | (e) $x^2 + 14x + 24$ | (f) $x^2 - 1$ |
| (g) $x^2 + 6x + 8$ | (h) $a^2 + 4a$ | (i) $r^2 - 4$ |
| (j) $x^2 + 10x + 21$ | (k) $y^2 - 16$ | (l) $5p^2 - 15pq$ |

3. Express each of the following in the form $(x + p)^2 + q$.

- | | | |
|---------------------|---------------------|---------------------|
| (a) $x^2 + 14x + 3$ | (b) $x^2 - 6x + 7$ | (c) $x^2 + 8x + 4$ |
| (d) $x^2 - 10x + 6$ | (e) $x^2 + 4x + 9$ | (f) $x^2 + 2x - 2$ |
| (g) $x^2 + 6x - 9$ | (h) $x^2 - 14x + 2$ | (i) $x^2 + 10x - 3$ |

Brackets and factorisation

Section C - Operational Skills Section

This section provides problems with the operational skills associated with Brackets and Factorisation

O1 I can multiply out brackets of the form $(\pm ax \pm by)(\pm cx \pm dy)$ including squared brackets.

1. Multiply out the brackets and simplify

- | | | |
|---|------------------------|--------------------|
| (a) $(4x + 1)(5x + 2)$ | (b) $(2x - 1)(x + 3)$ | (c) $(2x - 3)^2$ |
| (d) $(5x + 1)^2$ | (e) $(5x - 3)(2x - 5)$ | (f) $(7x + 2)^2$ |
| (g) $(x - 6)(3x - 1)$ | (h) $(4x + 5)(x - 2)$ | (i) $3(x - 2)^2$ |
| (j) $(6x - 5)(-3x + 4)$ | (k) $(3x - 2)(x + 4)$ | (l) $5(2x + 1)^2$ |
| (m) $(2x - 1)(3x - 2)$ | (n) $(x + 3)(-2x + 1)$ | (o) $-2(x - 7)^2$ |
| (p) $(-2x - 1)(7x + 2)$ | (q) $(x - 5)(3x + 4)$ | (r) $-5(3x + 4)^2$ |
| (s) $(-5x - 3)(-2x - 5)$ | (t) $4x(2x + 3)^2$ | (u) $-3x(x - 2)^2$ |
| (v) $(x + 1)(2x + 3) - (3x - 2)(x + 1)$ | | |
| (w) $(2x + 1)(x - 3) - (4x + 3)(x - 2)$ | | |

O2 I can multiply out brackets of the form $(\pm ax \pm by)(\pm cx \pm dy \pm ez)$.

1. Multiply out the brackets and simplify

- | | |
|-------------------------------|--------------------------------|
| (a) $(x + 4)(x^2 + 2x - 5)$ | (b) $(x - 2)(3x^2 - x + 8)$ |
| (c) $(x + 1)(3x^2 - 7x + 2)$ | (d) $(-2x + 3)(x^2 - 2x + 1)$ |
| (e) $(3x - 1)(2x^2 + x + 4)$ | (f) $(x + 2)(-4x^2 + x - 7)$ |
| (g) $(3x - 4)(2x^2 + 2x - 1)$ | (h) $(-x + 4)(-2x^2 + 4x - 1)$ |
| (i) $(5x - 3)(4x^2 - 7x + 2)$ | (j) $(-2x + 1)(3x^2 + 2x + 4)$ |

Brackets and factorisation

O3 I can factorise expressions which contain a difference of two squares.

1. Factorise fully

(a) $k^2 - 25$

(b) $t^2 - 49$

(c) $4 - m^2$

(d) $16 - n^2$

(e) $a^2 - 100$

(f) $b^2 - 64$

(g) $121 - x^2$

(h) $400 - y^2$

(i) $z^2 - 1$

(j) $169 - u^2$

(k) $v^2 - 144$

(l) $9 - w^2$

2. Factorise fully

(a) $25x^2 - 81$

(b) $36p^2 - 25q^2$

(c) $4x^2 - 81$

(d) $121 - 36x^2$

(e) $9x^2 - 400y^2$

(f) $64k^2 - l^2$

3. Factorise fully

(a) $98 - 8x^2$

(b) $5s^2 - 5t^2$

(c) $98 - 2x^2$

(d) $75x^2 - 243$

(e) $72 - 18x^2$

(f) $12x - 3x^3$

(g) $81 - x^4$

(h) $27w - 12w^3$

(i) $16a^4 - 4$

(j) $50x^3 - 2x$

(k) $5r^3 - 20r$

(l) $8p^5 - 2p$

Brackets and factorisation

04 I can factorise quadratic expressions of the form $ax^2 + bx + c$.

1. Factorise fully

(a) $x^2 + 5x + 6$

(b) $x^2 + 11x + 10$

(c) $x^2 + 10x + 21$

(d) $x^2 + 8x + 16$

(e) $x^2 + 7x + 6$

(f) $x^2 + 8x + 15$

2. Factorise fully

(a) $2x^2 - 7x + 3$

(b) $2x^2 + 11x + 12$

(c) $3x^2 + 10x + 8$

(d) $x^2 + x - 6$

(e) $6x^2 + 7x + 2$

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

(g) $5x^2 + 4x - 1$

(h) $7x^2 + 16x + 4$

(i) $2x^2 + 7x - 15$

(j) $x^2 - 2x - 15$

(k) $4x^2 + 13x + 3$

(l) $12x^2 - 4x - 1$

(m) $8x^2 + 2x - 3$

(n) $8x^2 + 6x - 9$

(o) $9x^2 + 15x + 4$

3. Factorise fully

(a) $6 - x - x^2$

(b) $20 + 11x - 3x^2$

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

(d) $15 - 7x - 2x^2$

(e) $4 - 7x - 2x^2$

(f) $12 - 20x - 8x^2$

Brackets and factorisation

05 *I can factorise expression which have a combination of common factor, difference of two squares or trinomial quadratic.*

1. Factorise fully

(a) $3x^2 + 6x - 24$

(b) $15x^2y + 5x$

(c) $2x^2 - 32$

(d) $5x^3 - 45x$

(e) $18x^2 - 6x - 12$

(f) $12x^2y + 8xy^3$

(g) $10x^2 + 25x - 15$

(h) $6x^3 + 30x^2 + 36x$

(i) $7x^2 - 28$

(j) $2x^2 - 10x + 12$

(k) $3x^3 + 21x^2 + 54x$

(l) $6x^3 - 63x$

06 *I can express a quadratic in the form $a(x - b)^2 + c$*

1. Express in the form $(x - b)^2 + c$.

(a) $x^2 + 8x + 3$

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

(c) $x^2 - 6x + 4$

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

(e) $x^2 - 2x - 7$

(f) $x^2 + 8x - 5$

(g) $x^2 + 5x + 2$

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

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

2. Express in the form $a(x - b)^2 + c$. (Higher Extension)

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

(b) $5x^2 + 10x + 1$

(c) $3x^2 - 12x + 2$

(d) $4x^2 + 8x - 7$

(e) $2x^2 - 12x + 3$

(f) $5x^2 + 40x - 7$

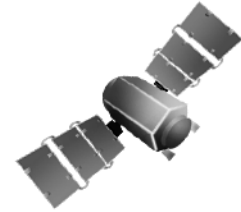
Brackets and factorisation

Section D - Reasoning Skills Section

This section provides problems with Reasoning Skills in the context of Brackets and Factorisation

1. A satellite travels at a speed of $3x + 2$ kilometres per hour for $4x - 1$ hours.

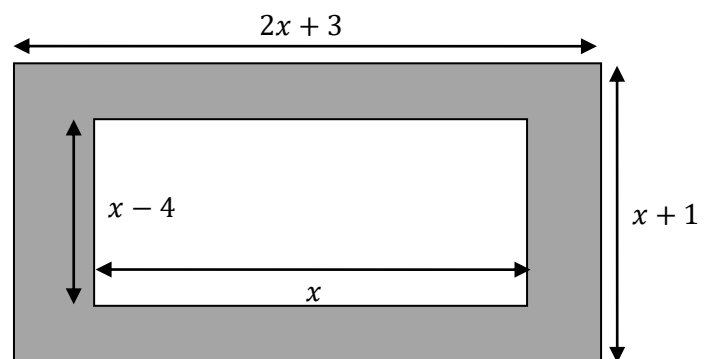
Show that the distance travelled by the satellite (D kilometres) is given by $= 12x^2 + 5x - 2$.



2. Expand $(x^{\frac{1}{2}} + 1)(x^{\frac{1}{2}} + x^{-\frac{1}{2}})$

3. Look at the diagram.

Show that the shade area can be represented by $A = x^2 + 9x + 3$.



4. (a) Factorise $a^2 - b^2$

(b) Hence find the value of $2 \cdot 4^2 - 1 \cdot 6^2$.

5. Gillian says that $(x + 3)^2 - (x + 1)^2 = 4(x + 2)$.

Kenny says that $(x + 3)^2 - (x + 1)^2 = 2(4x + 5)$.

Which of the two students is correct?

Justify your answer with working.

Brackets and factorisation

Answers

Section A

R1

- Q1 (a) $15x + 20$ (b) $14a - 35$ (c) $12y + 3$ (d) $14b - 10c$ (e) $6p + 3q$
(f) $8r - 40$ (g) $18x^2 - 15x$ (h) $6y^2 - 2y$ (i) $5a^2 - 5ab$ (j) $-24x + 30$
(k) $-6t + 2u$ (l) $15 - 21x$ (m) $-54 + 18a$ (n) $6x - 10y + 14$
(o) $24 + 32c$ (p) $-21x^2 - 9x$ (q) $14ab + 6ac + 2a$
(r) $-4x + 8x^2$

- Q2 (a) $5\sqrt{3} - \sqrt{5}$ (b) $2\sqrt{3} - \sqrt{6}$ (c) 9

- Q3 (a) $x^6 + x^{-1}$ (b) $r^{-2} + r^5$ (c) $a^{-4} + a^{-2}$ (d) $2x + 10x^2$ (e) $15a + 3$
(f) $a - 1$ (g) $2t^{-6} - 1$ (h) $15m^4 + 20m^{-2}$ (i) $k + 1$

R2

- Q1 (a) $3x + 13$ (b) $15a + 2$ (c) $24 + 3y$ (d) $6b - 8$ (e) $6p + 9q$
(f) $5r - 40$ (g) $18x^2 - 11x + 3$ (h) $6y^2$ (i) $5a$

- Q2 (a) $22x + 23$ (b) $4a - 19$ (c) $16b + 2c$ (d) $18p + 5q$
(e) $-5x^2 - 27x$ (f) $4y^2$

R3

- Q1 (a) $4(2x + 3y)$ (b) $5(2a + 3b)$ (c) $7(3p + 5q)$ (d) $m(2n + p)$ (e) $r(5s + t)$
(f) $y(7x + 2z)$ (g) $3p(3q - 4r)$ (h) $4x(2y - 5z)$ (i) $5p(p - 3q)$

- Q2 (a) $x(3x - 2y + 6)$ (b) $4x(2x - 4t + a)$

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(c) $x(3x - 2y)$

(d) $5x^2(5 - y)$

(e) $5a^2(2 - 7b)$

(f) $3t(8 - tr)$

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

(h) $16ab(b^2 - 2 + 3b)$

(i) $5x^2(5a + 8x)$

Section B

Q1 (a) $3t^2 - tu$

(b) $a^2 + 7a + 12$

(c) $2y^2 - yz$

(d) $6b^2 - 2bc$

(e) $d^2 + 7d + 10$

(f) $4x^2 + 5x$

(g) $e^2 + 10e + 21$

(h) $g^2 + 10g + 24$

(i) $15a^2 - 10a$

Q2 (a) $p(p - 3)$

(b) $(x + 3)(x + 2)$

(c) $x(x + 5)$

(d) $(x - 5)(x + 5)$

(e) $(x + 12)(x + 2)$

(f) $(x - 1)(x + 1)$

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

(h) $a(a + 4)$

(i) $(r - 2)(r + 2)$

(j) $(x + 7)(x + 3)$

(k) $(y - 4)(y + 4)$

(l) $5p(p - 3q)$

Q3 (a) $(x + 7)^2 - 46$

(b) $(x - 3)^2 - 2$

(c) $(x + 4)^2 - 12$

(d) $(x - 5)^2 - 19$

(e) $(x + 2)^2 + 5$

(f) $(x - 1)^2 - 3$

(g) $(x + 3)^2 - 18$

(h) $(x + 5)^2 - 28$

Section C

O1

Q1 (a) $20x^2 + 13x + 2$

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

Brackets and factorisation

- (c) $4x^2 - 12x + 9$ (d) $25x^2 + 10x + 1$
(e) $10x^2 - 31x + 15$ (f) $49x^2 + 28x + 4$
(g) $3x^2 - 19x + 6$ (h) $4x^2 - 3x - 10$
(i) $3x^2 - 12x + 12$ (j) $-18x^2 + 39x - 20$
(k) $3x^2 + 10x - 8$ (l) $20x^2 + 20x + 5$
(m) $6x^2 - 7x + 2$ (n) $-2x^2 - 5x + 3$
(o) $-2x^2 + 28x - 98$ (p) $-14x^2 - 11x - 2$
(q) $3x^2 - 11x - 20$ (r) $-45x^2 - 120x - 80$
(s) $10x^2 + 31x + 15$ (t) $16x^3 + 48x^2 + 36x$
(u) $-3x^3 + 12x^2 - 12x$ (v) $-x^2 + 4x + 5$
(w) $-2x^2 + 3$

O2

- Q1 (a) $x^3 + 6x^2 + 3x - 20$ (b) $3x^3 - 7x^2 + 10x - 16$
(c) $3x^3 - 4x^2 - 5x + 2$ (d) $-2x^3 + 7x^2 - 8x + 3$
(e) $6x^3 + x^2 + 11x - 4$ (f) $-4x^3 - 7x^2 - 5x - 14$
(g) $6x^3 - 2x^2 - 11x + 4$ (h) $2x^3 - 12x^2 + 17x - 4$
(i) $20x^3 - 47x^2 + 31x - 6$ (j) $-6x^3 - x^2 - 6x + 4$

O3

- Q1 (a) $(k - 5)(k + 5)$ (b) $(t - 7)(t + 7)$
(c) $(2 - m)(2 + m)$ (d) $(4 - n)(4 + n)$
(e) $(a - 10)(a + 10)$ (f) $(b - 8)(b + 8)$
(g) $(11 - x)(11 + x)$ (h) $(20 - y)(20 + y)$
(i) $(z - 1)(z + 1)$ (j) $(13 - u)(13 + u)$
(k) $(v - 12)(v + 12)$ (l) $(3 - w)(3 + w)$

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- Q2 (a) $(5x - 9)(5x + 9)$ (b) $(6p - 5q)(6p + 5q)$
(c) $(2x - 9)(2x + 9)$ (d) $(11 - 6x)(11 + 6x)$
(e) $(3x - 20y)(3x + 20y)$ (f) $(8k - l)(8k + l)$

- Q3 (a) $2(7 - 2x)(7 + 2x)$ (b) $5(s - t)(s + t)$
(c) $2(7 - x)(7 + x)$ (d) $3(5x - 9)(5x + 9)$
(e) $18(2 - x)(2 + x)$ (f) $3x(2 - x)(2 + x)$
(g) $(9 + x^2)(3 - x)(3 + x)$ (h) $3w(3 - 2w)(3 + 2w)$
(i) $4(2a^2 + 1)(2a^2 - 1)$ (j) $2x(5x - 1)(5x + 1)$
(k) $5r(r - 2)(r + 2)$ (l) $2p(2p^2 + 1)(2p^2 - 1)$

O4

- Q1 (a) $(x + 3)(x + 2)$ (b) $(x + 10)(x + 1)$
(c) $(x + 7)(x + 3)$ (d) $(x + 4)^2$
(e) $(x + 6)(x + 1)$ (f) $(x + 5)(x + 3)$

- Q2 (a) $(2x - 1)(x - 3)$ (b) $(2x + 3)(x + 4)$
(c) $(3x + 4)(x + 2)$ (d) $(x - 2)(x + 3)$
(e) $(3x + 2)(2x + 1)$ (f) $(x - 1)(x - 2)$
(g) $(5x - 1)(x + 1)$ (h) $(7x + 2)(x + 2)$
(i) $(2x - 3)(x + 5)$ (j) $(x + 3)(x - 5)$
(k) $(4x + 1)(x + 3)$ (l) $(6x + 1)(2x - 1)$
(m) $(4x + 3)(2x - 1)$ (n) $(4x - 3)(2x + 3)$
(o) $(3x + 4)(3x + 1)$

- Q3 (a) $(3 + x)(2 - x)$ (b) $(5 - x)(4 + 3x)$

Brackets and factorisation

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

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

(e) $(4 + x)(1 - 2x)$

(f) $4(3 + x)(1 - 2x)$

O5

Q1 (a) $3(x - 2)(x + 4)$

(b) $5x(3xy + 1)$

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

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

(e) $6(3x + 2)(x - 1)$

(f) $4xy(3x + 2y^2)$

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

(h) $6x(x + 3)(x + 2)$

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

(j) $2(x - 3)(x - 2)$

(k) $3x(x^2 + 7x + 18)$

(l) $3x(2x^2 - 21)$

O6

Q1 (a) $(x + 4)^2 - 13$

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

(c) $(x - 3)^2 - 5$

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

(e) $(x - 1)^2 - 8$

(f) $(x + 4)^2 - 21$

(g) $\left(x + \frac{5}{2}\right)^2 - \frac{17}{4}$

(h) $\left(x + \frac{7}{2}\right)^2 - \frac{53}{4}$

(i) $\left(x + \frac{3}{2}\right)^2 - \frac{5}{4}$

Q2 (a) $2(x + 1)^2 + 3$

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

(c) $3(x - 2)^2 - 10$

(d) $4(x + 1)^2 - 11$

(e) $2(x - 3)^2 - 15$

(f) $5(x + 4)^2 - 87$

Section D

Q1 $12x^2 + 5x - 2$ as required.

Q2 $x + x^{1/2} + x^{-1/2} + 1$

Brackets and factorisation

Q3 $x^2 + 9x + 3$ as required.

Q4 (a) $(a - b)(a + b)$ (b) $3 \cdot 2$

Q5 Gillian is correct as Kenny missed the negative outside the second bracket.