

Section 1: Quadratic graphs and equations

Solutions to Exercise level 2

$$1. \quad (i) \quad ax^2 - 2ax - 3a = a(x^2 - 2x - 3) \\ = a(x-3)(x+1)$$

$$(ii) \quad 2cx^2 + c(6a+b)x + 3abc = c[2x^2 + (6a+b)x + 3ab] \\ = c(x+3a)(2x+b)$$

$$2. \quad (i) \quad \frac{x^2 + x - 6}{x^2 - x - 2} = \frac{(x+3)\cancel{(x-2)}}{\cancel{(x-2)}(x+1)} = \frac{x+3}{x+1}$$

$$(ii) \quad \frac{x^2 - 4x + 4}{x^2 + x - 6} = \frac{(x-2)^2}{(x+3)\cancel{(x-2)}} = \frac{x-2}{x+3}$$

$$(iii) \quad \frac{x^2 + x - 2}{x^2 + 4x + 3} = \frac{(x+2)(x-1)}{(x+3)(x+1)}$$

This expression cannot be simplified.

$$(iv) \quad \frac{4x^2 - 1}{4x^2 - 4x - 3} = \frac{\cancel{(2x+1)}(2x-1)}{\cancel{(2x+1)}(2x-3)} = \frac{2x-1}{2x-3}$$

$$(v) \quad \frac{2x+3}{3x+1} \times (3x^2 - 2x - 1) = \frac{2x+3}{3x+1} \times \cancel{(3x+1)}(x-1) = (2x+3)(x-1)$$

$$(vi) \quad \frac{x+2}{2x^2 - x - 1} \div \frac{x^2 - x - 6}{2x+1} = \frac{x+2}{(2x+1)(x-1)} \div \frac{(x-3)(x+2)}{2x+1} \\ = \frac{\cancel{x+2}}{\cancel{(2x+1)}(x-1)} \times \frac{\cancel{2x+1}}{(x-3)\cancel{(x+2)}} \\ = \frac{1}{(x-1)(x-3)}$$

$$3. \quad (i) \quad 4x^2 - 3x - 10 = 0 \\ (4x+5)(x-2) = 0 \\ x = -\frac{5}{4} \text{ or } x = 2$$

$$(ii) \quad 6x^2 - 19x + 10 = 0 \\ (3x-2)(2x-5) = 0 \\ x = \frac{2}{3} \text{ or } x = \frac{5}{2}$$

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4. Let x be the width of the rectangle, so the length is $x + 3$.

$$\text{Area} = x(x + 3)$$

$$x(x + 3) = 40$$

$$x^2 + 3x = 40$$

$$x^2 + 3x - 40 = 0$$

$$(x + 8)(x - 5) = 0$$

$$x = -8 \text{ or } 5$$

Dimensions must be positive, so width is 5 cm and length is 8 cm.

5. (i) Let $y = x^2$

$$y^2 - 5y + 4 = 0$$

$$(y - 1)(y - 4) = 0$$

$$y = 1 \text{ or } 4$$

$$x^2 = 1 \text{ or } 4$$

$$x = \pm 1 \text{ or } \pm 2$$

- (ii) Let $y = x^2$

$$4y^2 + 11y - 3 = 0$$

$$(4y - 1)(y + 3) = 0$$

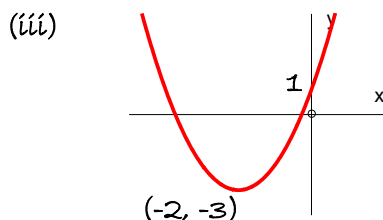
$$y = \frac{1}{4} \text{ or } -3$$

$$x^2 = \frac{1}{4} \text{ or } -3$$

$$x = \pm \frac{1}{2}$$

6. (i) $x^2 + 4x + 1 = (x + 2)^2 - 4 + 1$
 $= (x + 2)^2 - 3$

- (ii) Line of symmetry is $x = -2$
vertex (minimum point) is $(-2, -3)$



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7. (i) $x^2 - 3x + 1 = (x - \frac{3}{2})^2 - \frac{9}{4} + 1$
 $= (x - \frac{3}{2})^2 - \frac{5}{4}$

