

Recap Sec 2 Solving Quadratic Equations

Factorisation methods:

1. Take out common factor
2. Grouping (4 terms)
3. $a^2 - b^2$
4. Box method

Exercise 1

1	Solve the following quadratic equations. a) $x^2 - 5x = 0$ b) $x^2 = 8x$ c) $p^2 - 4 = 0$ d) $x^2 - 5x - 6 = 0$ e) $2x^2 + 3x = 2$
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Quadratic formula

For the equation $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Exercise 2

1	Solve each of the following equations using the quadratic formula. (a) $7x^2 - x - 5 = 0$ (b) $6x^2 - 3x - 8 = 0$ (c) $14x^2 - 5x - 1 = 0$
2	Solve the equation using quadratic formula. $(3x - 1)^2 + x - 10 = 0$
3	Solve the equation $(3x - 1)(x + 4) = 5(2x + 3)$ by using the quadratic formula.

Completing the square

For $ax^2 + bx + c = 0$,

Steps:

1. Make sure coefficient of x^2 is 1
2. Take coefficient of x and divide by 2
- 3.

$$x^2 + bx + \left(\frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c = 0$$

$$\left(x \pm \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c = 0$$

Example: Complete square for $x^2 - 3x + 1$

$$\underbrace{x^2 - 3x + \left(\frac{3}{2}\right)^2}_{\left(x - \frac{3}{2}\right)^2} - \underbrace{\left(\frac{3}{2}\right)^2 + 1}_{+1}$$

$$= (x - \frac{3}{2})^2 - \frac{5}{4}$$

Exercise 3

1	Complete square for a) $x^2 - 2x + 5$ b) $x^2 - 3x - 1$
2	Using completing the square method, solve the equation $x^2 + 4x + 2 = 0$.
3	Solve the equation $x^2 - 5x + \frac{1}{4} = 0$ using completing the square method.
4	Solve the equation by completing the square $2x + 10 = x^2 + x$
5	a) Complete the square for $2x^2 - 5x + 1$ b) Hence, solve $2x^2 - 5x + 1 = 0$
6	a) Complete the square for $-x^2 - 4x - 2$ b) Hence, solve $-x^2 - 4x - 2 = 1$

Problems involving Quadratic Equations

Exercise 4

1	<p>(a) Samuel cycled 40 km from Town A to Town B at a constant speed of x km/h. Write down an expression, in terms of x, for the number of hours he took to cycle. [1]</p> <p>(b) He then jogged 10 km from Town B to Town C at a constant speed of $(x - 60)$ km/h. Write down an expression, in terms of x, for the number of hours he took to jog. [1]</p> <p>(c) Given that Samuel took 15 minutes more for the second part of the journey, form an equation in x and show that it reduces to $x^2 + 60x - 9600 = 0$. [2]</p> <p>(d) Solve the equation $x^2 + 60x - 9600 = 0$, giving your answers correct to 2 decimal places. [3]</p> <p>(e) Hence calculate</p> <p style="padding-left: 20px;">(i) the time, in minutes, Samuel took to cycle from Town A to Town B, [2]</p> <p style="padding-left: 20px;">(ii) the average speed, in km/h, for the entire journey from Town A to Town C. [1]</p>
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2	<p>Alan's car can run x kilometres on one litre of petrol.</p> <p>(a) Write down an expression, in terms of x, the number of litres of petrol used when he travels from Town A to Town B, which is 350 km apart. [1]</p> <p>Alan buys a new car which enables him to run an extra 2.5 km for each litre of petrol.</p> <p>(b) Write down an expression, in terms of x, the number of litres of petrol used by the new car when Alan travels from Town A to Town B. [1]</p> <p>(c) Given that the new car used 5 litres less petrol to go from Town A to Town B as compared to the old car, form an equation in x and show that it simplifies to</p> $2x^2 + 5x - 350 = 0. \quad [3]$ <p>(d) Solve the equation $2x^2 + 5x - 350 = 0$, giving both answers correct to two decimal places. [3]</p> <p>(e) Given that each litre of petrol costs \$1.85, calculate the total cost of petrol used by the new car travelling from Town A to Town B. [2]</p>
3	<p>Mark has a budget of \$120 to buy cupcakes for his colleagues.</p> <p>(a) Given that the price of each cupcake is \$$x$, write down an expression in x for the number of cupcakes that he can buy. [1]</p> <p>(b) At the shop, he discovers that the price of each cupcake has risen by \$0.50. Write down and simplify an expression in x for the number of cupcakes he can buy now. [1]</p> <p>(c) Due to the increase in price, Mark could only buy 6 fewer cupcakes. Form an equation in x and show that it reduces to $2x^2 + x - 20 = 0$. [3]</p> <p>(d) Solve the equation $2x^2 + x - 20 = 0$, giving your answers to 1 decimal place. [2]</p> <p>(e) Using your answer in (d), calculate the number of cupcakes he could afford before the increase in price. [1]</p>

Solving by Graphical Method

Exercise 5

- a) Find p and use a suitable scale, plot the graph $y = 2x^2 - 3x - 1$ for $-3 \leq x \leq 3$ on a graph paper.

x	-3	-2	-1	0	1	2	3
y	26	13	4	-1	p	1	8

- b) Solve the equation $2x^2 - 3x - 1 = 0$ graphically.
c) Solve the equation $2x^2 - 3x = 2$ graphically.