



# Equations, Inequalities, Quadratics, and Finance

# 9 Unit Test

**Free and always will be!**

**Instructions:** Read all questions carefully to ensure you understand what is being asked. When completing your official tests / exams, your grade will be based upon your: **understanding, fluency, reasoning, and problem solving**, so ensure you show all lines of working and draw accurate, labelled diagrams where necessary. (ACiQ|9.0 Mathematics standard elaborations found on final page (general assessment marking standards)). [Practise tests are marked out of a score of 10]. For multiple choice questions, tick or fill in the circle next to the corresponding letter under the question.

Check your work if you have time. *Remember:* you don't have to start at question one, it's always best to firstly look through the test, highlight the easy looking questions and complete them first, then secondly, go back through and work on the harder questions. Good luck! And remember to breathe!

$$\Sigma = \frac{\quad}{10} = \quad \%$$

## Part 1: Multiple Choice (2 marks)

### Question 1:

a) Which of the following equations represents a linear relationship?

A.  $y = x^2 + 2$

B.  $y = 3x - 4$

C.  $y = \sqrt{x}$

D.  $y = \frac{1}{x}$

☐ A

☐ B

☐ C

☐ D

Space for question 1a...



**b) Solve the linear inequality  $-5x < 10$  ?**

**A.**  $x > 2$

**B.**  $x > -2$

**C.**  $x < 2$

**D.**  $x < -2$

☐ **A**

☐ **B**

☐ **C**

☐ **D**

Space for question 1b...

**Question 2:**

**a) The graph of  $y = x^2$  is:**

**A.** A straight line

**B.** A parabola opening upwards

**C.** A parabola opening downwards

**D.** A hyperbola

☐ **A**

☐ **B**

☐ **C**

☐ **D**

**b) Which of the following equations is used for finding simple interest?**

**A.**  $I = PRT$

**B.**  $I = \frac{PRT}{n}$

**C.**  $I = PRT^n$

**D.**  $I = \frac{PR}{T}$

☐ **A**

☐ **B**

☐ **C**

☐ **D**

Space for question 2b...



## Part 2: Short Answer (4 marks)

### Question 3:

a) Solve the linear equation  $-x - 12 = -3$ .

b) Sketch the graph of the linear function  $y = 2x + 1$ . Indicate the *slope* and *y - intercept*.



**Question 4:**

**a) Explain the difference between linear and quadratic functions in terms of their graphs.**

**b) Calculate the simple interest earned on an investment of \$250 at an interest rate of 4 % *per annum* for 3 years . Show your working using the formula  $I = PRT$  .**



### Part 3: Problem Solving (4 marks)

#### Question 5:

a) Solve the system of equations using elimination:  $\begin{cases} 2x + 3y = 8 \\ 2x - y = 2 \end{cases}$ .

b) Given the quadratic function  $y = -x^2 + 4x - 3$  : Determine the vertex of the parabola and the  $y$  - *intercept* . Sketch the graph.



**Question 6:**

a) Solve  $4x^2 + 8x - 12 = 0$ .



**b) A line passes through the points  $(1, 3)$  and  $(4, 9)$ . Find the equation of the line in slope-intercept form. Sketch the graph of this line.**

A large, empty rectangular box with a thin black border, intended for the student to show their work, including calculations for the line's equation and a hand-drawn sketch of the line.



## Solutions

1a. (0.5 marks)

B.  $y = 3x - 4$ .

This is the only equation where  $y$  increases at a constant rate with respect to  $x$ , representing a straight line (It's the only one with a power of one on the  $x$ ).

b. (0.5 marks)

B.  $x > -2$

2. (0.5 marks)

B. A parabola opening upwards.

$y = x^2$  represents a quadratic function with a positive coefficient for  $x^2$ , hence it opens upwards.

b. (0.5 marks)

A.  $I = PRT$

3a. (1 mark)

Add 12 to both sides:

$$-x - 12 = -3$$

$$-x - 12 + 12 = -3 + 12$$

$$-x = 9,$$

Divide by  $-1$ :

$$-1x = 9$$

$$\cancel{-1}x = 9$$

$$\cancel{-1} = -1$$

$$x = -9.$$

b. (1 mark)

$$y = 2x + 1$$

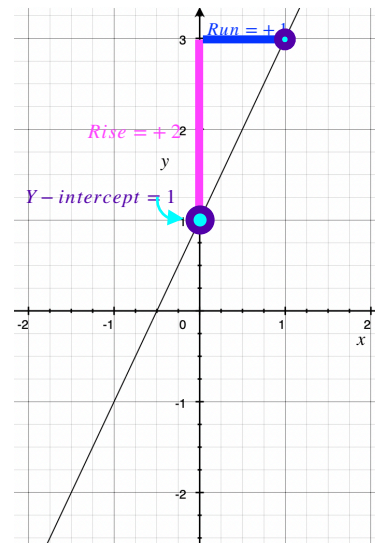
$$y = mx + c$$

Slope ( $m$ ):

$$m = 2 = \frac{+2}{+1} = \frac{\text{rise}}{\text{run}}.$$

$y$ -intercept ( $c$ ):

$$c = +1.$$



[Description for drawing on graph paper with labelled axes :

Draw a point at  $x = 1$ , then go up 2 and across 1, draw a point here, then draw a straight line between the two points. ]





**4a. (1 mark)**

**Linear functions** produce straight lines on their graphs, where the change in  $y$  is proportional to the change in  $x$  with a constant slope.

**Quadratic functions** produce parabolas, which are U-shaped curves. The graph of a quadratic function can open upwards or downwards, and the rate of change of  $y$  with respect to  $x$  is not constant but changes according to the square of  $x$ .

**b. (1 mark)**

$$P = 250 \text{ (principal)}$$

$$R = 4 \%$$

$$= \frac{4}{100}$$

$$= 0.04 \text{ (rate as a decimal in years)}$$

$$T = 3 \text{ (time in years)}$$

$$I = PRT$$

$$I = 250 \times 0.04 \times 3$$

$$= 100 \times 3$$

$$= 30.$$

The simple interest earned is \$30.



## 5a. (1 mark)

$$\begin{cases} 2x + 3y = 8 \\ 2x - y = 2 \end{cases}$$

If signs are:

opposite  $\rightarrow$  change to  $-$ same  $\rightarrow$  change to  $+$ 

Subtract the second equation from the first:

$$(2x + 3y) - (2x - y) = 8 - 2$$

$$\boxed{2x} + 3y - \boxed{2x} + y = 6$$

$$\cancel{2x} + 3y - \cancel{2x} + y = 6$$

$$4y = 6$$

$$\frac{\cancel{4}y}{\cancel{4}} = \frac{6}{4}$$

$$y = \frac{6}{4}$$

$$y = 1.5,$$

Substitute  $y = 1.5$  into  $2x - y = 2$ :

$$2x - 1.5 = 2$$

$$2x = 3.5$$

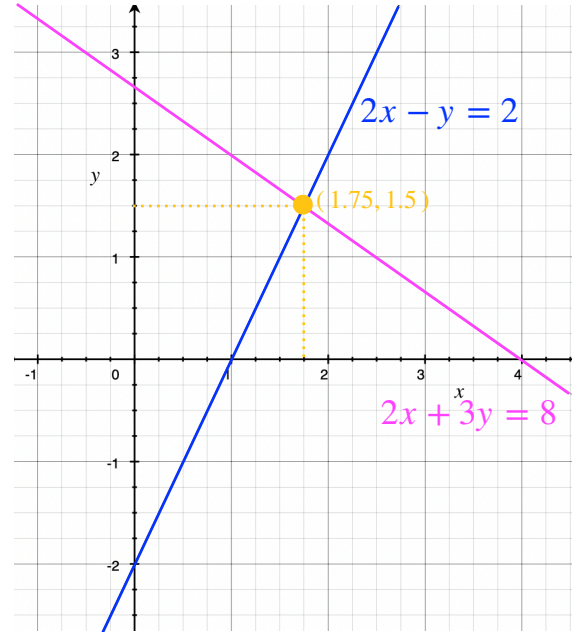
$$\frac{\cancel{2}x}{\cancel{2}} = \frac{3.5}{2}$$

$$x = \frac{3.5}{2}$$

$$x = 1.75,$$

Solution:

$$x = 1.75, y = 1.5.$$





b. (1 mark)

Vertex, use the formula :

$$x = -\frac{b}{2a} \text{ where } a = -1 \text{ and } b = 4 :$$

$$\begin{aligned} x &= -\frac{4}{2 \times (-1)} \\ &= \frac{-4}{-2} \\ &= \frac{\cancel{1} \times 4}{\cancel{1} \times 2} \\ &= \frac{4}{2} \\ &= 2. \end{aligned}$$

Substituting  $x = 2$  into the equation for  $y$  :

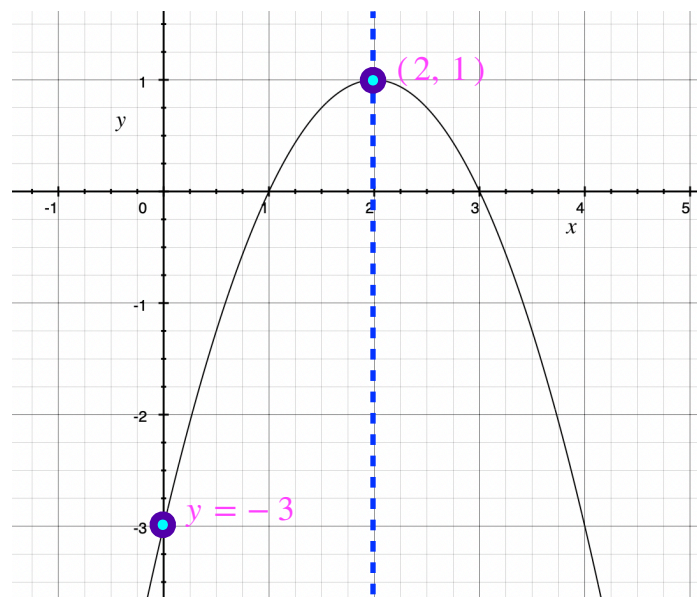
$$\begin{aligned} y &= -(2)^2 + 4(2) - 3 \\ &= -4 + 8 - 3 \\ &= 1. \end{aligned}$$

Substituting  $x = 0$  into the equation for  $y$  :

$$\begin{aligned} y &= -(0)^2 + 4(0) - 3 \\ &= 0 + 0 - 3 \\ &= -3. \end{aligned}$$

So, the vertex is at  $(2, 1)$ , and the  $y$  - *intercept* is at  $y = -3$ .

[Description for sketching:

Draw a parabola opening downwards with the vertex at  $(2, 1)$ .The parabola crosses the  $y$  - *axis* at  $y = -3$  (when  $x = 0$ )and has symmetry about  $x = 2$ .]



6a. (1 mark)

Factor out the common factor (4) :

$$4x^2 + 8x - 12 = 0$$

$$4 \cdot x^2 + 4 \cdot 2x + 4 \cdot (-3) = 0$$

$$4(x^2 + 2x - 3) = 0$$

Factorise  $x^2 + 2x - 3$  :Numbers are 3 and  $-1$ ,

$$\begin{aligned} &\rightarrow x^2 + 2x - 3 \\ &= (x + 3)(x - 1) \end{aligned}$$

$$\text{So, } 2x^2 + 4x - 6 = 0$$

$$\rightarrow 2(x + 3)(x - 1) = 0$$

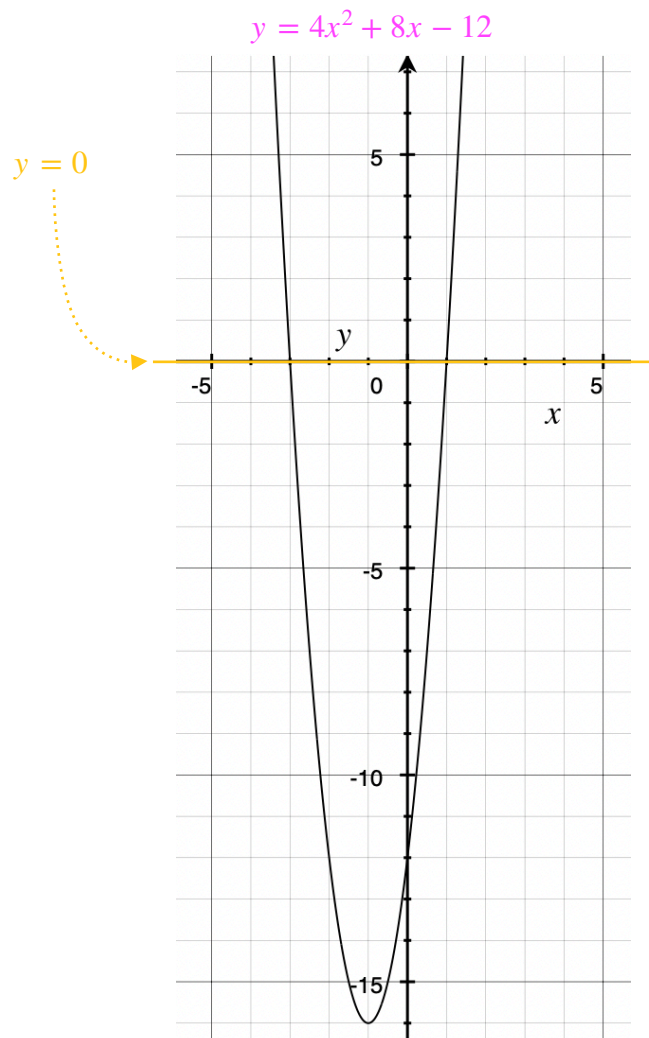
$$\frac{\cancel{2}(x + 3)(x - 1)}{\cancel{2}} = \frac{0}{2}$$

$$(x + 3)(x - 1) = 0$$

Solutions:

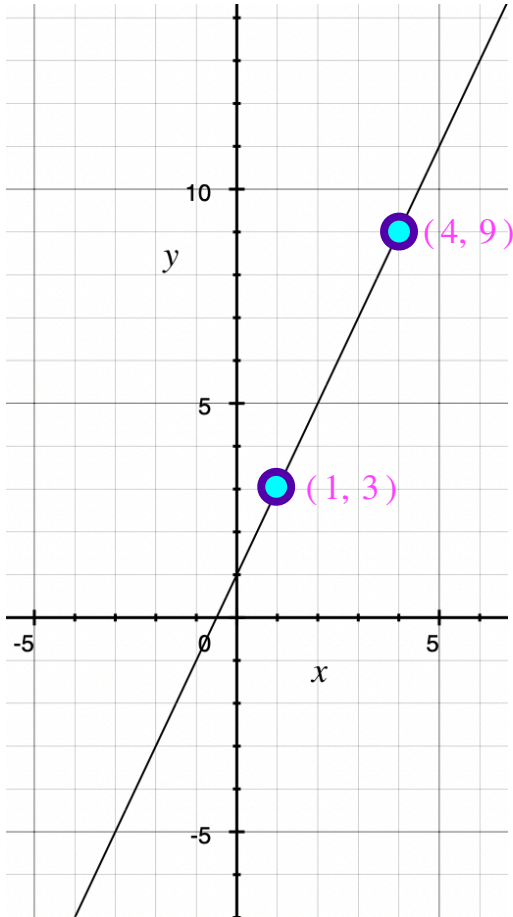
$$x + 3 = 0 \text{ or } x - 1 = 0$$

$$x = -3 \text{ or } x = 1.$$





b. (1 mark)



Point 1 :

$$= (1, 3)$$

$$= (x_1, y_1)$$

Point 2 :

$$= (4, 9)$$

$$= (x_2, y_2)$$

Slope ( $m$ ) :

$$m = \frac{\text{rise}}{\text{run}}$$

$$= \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{9 - 3}{4 - 1}$$

$$= \frac{6}{3}$$

$$m = 2 = \frac{2}{1} = \frac{\text{rise}}{\text{run}}$$

Point-slope form:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m \times (x_2 - x_1) = \frac{y_2 - y_1}{\cancel{x_2 - x_1}} \times \cancel{(x_2 - x_1)}$$

$$m(x - x_1) = y - y_1$$

$$\rightarrow y - y_1 = m(x - x_1)$$

Using point-slope form with point (1, 3) :  $y - 3 = 2(x - 1)$ 

Simplify to slope-intercept form:

$$y - 3 = 2(x - 1)$$

$$y - 3 = 2x - 2$$

$$y \cancel{-3} \cancel{+3} = 2x - 2 \cancel{+3}$$

$$y = 2x + 1.$$

[ Description for sketching: Draw a straight line passing through (1,3) and (4,9) ].

$$\Sigma = \frac{\quad}{10} = \quad \%$$



## General Assessment Marking Standards

**Remember:** When your official tests are marked, they won't be a score out of 10, they will be a grade (A,B,C,D,E) based on the following standards:

ACiQ|v9.0

### Year 9 Mathematics standard elaborations

		A	B	C	D	E
		The folio of student work contains evidence of the following:				
Mathematical proficiencies	Understanding	accurate and <b>consistent</b> identification, representation, description and connection of mathematical concepts and relationships in <b>complex unfamiliar</b> , complex familiar, and simple familiar situations	<b>accurate</b> identification, representation, description and connection of mathematical concepts and relationships in <b>complex familiar</b> and simple familiar situations	identification, representation, description and connection of mathematical concepts and relationships in simple familiar situations	<b>partial</b> identification, representation and description of mathematical concepts and relationships in <b>some</b> simple familiar situations	<b>fragmented</b> identification, representation and description of mathematical concepts and relationships in <b>isolated and obvious</b> situations
	Fluency	choice, use and application of <b>comprehensive</b> facts, definitions, and procedures to find solutions in <b>complex unfamiliar</b> , complex familiar, and simple familiar situations	choice, use and application of <b>effective</b> facts, definitions, and procedures to find solutions in <b>complex familiar</b> and simple familiar situations	choice, use and application of facts, definitions, and procedures to find solutions in simple familiar situations	choice and use of <b>partial</b> facts, definitions, and procedures to find solutions in <b>some</b> simple familiar situations	choice and use of <b>fragmented</b> facts, definitions and procedures to find solutions in <b>isolated and obvious</b> situations
	Reasoning	<b>comprehensive</b> explanation of mathematical thinking, strategies used, and conclusions reached in <b>complex unfamiliar</b> , complex familiar, and simple familiar situations	<b>detailed</b> explanation of mathematical thinking, strategies used, and conclusions reached in <b>complex familiar</b> and simple familiar situations	explanation of mathematical thinking, strategies used, and conclusions reached in simple familiar situations	<b>partial</b> explanation of mathematical thinking, strategies used, and conclusions reached in <b>some</b> simple familiar situations	<b>fragmented</b> explanation of mathematical thinking, strategies used, and conclusions reached in <b>isolated and obvious</b> situations
	Problem-solving	<b>purposeful</b> use of problem-solving approaches to find solutions to problems.	<b>effective</b> use of problem-solving approaches to find solutions to problems.	use of problem-solving approaches to find solutions to problems.	<b>partial</b> use of problem-solving approaches to <b>make progress towards</b> finding solutions to problems.	<b>fragmented</b> use of problem-solving approaches to make progress towards finding solutions to problems.

**Key** shading emphasises the qualities that discriminate between the A–E descriptors

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