C13

Equations and inequalities

CHAPTER ASSIGNMENT · 472 MARKS

Name _____ Class _____ No. _____ Date _____

Show your working. A fraction bar in the book is written here with brackets and /, so (x + 1)/2 means x + 1 over 2. Diagrams from the book are described in words and are not drawn to scale. Use a calculator only for Exercises 13.10 and 13.11 and Student assessment questions that need the quadratic formula.

Practice questions from *Cambridge IGCSE Mathematics Core and Extended* (4th edition), Chapter 13 (Equations and inequalities), for classroom use. The book's diagrams are described in words. The Check yourself and Chapter quiz questions are Guru Jazzy's own.

Exercise 13.1 · Linear equations

13.1.1 Solve the following linear equations:

(a) $3x = 2x - 4$	(b) $5y = 3y + 10$	(c) $2y - 5 = 3y$
(d) $p - 8 = 3p$	(e) $3y - 8 = 2y$	(f) $7x + 11 = 5x$

13.1.2 Solve the following linear equations:

(a) $3x - 9 = 4$	(b) $4 = 3x - 11$	(c) $6x - 15 = 3x + 3$
(d) $4y + 5 = 3y - 3$	(e) $8y - 31 = 13 - 3y$	(f) $4m + 2 = 5m - 8$

13.1.3 Solve the following linear equations:

(a) $7m - 1 = 5m + 1$	(b) $5p - 3 = 3 + 3p$	(c) $12 - 2k = 16 + 2k$
(d) $6x + 9 = 3x - 54$	(e) $8 - 3x = 18 - 8x$	(f) $2 - y = y - 4$

13.1.4 Solve the following linear equations:

(a) $x/2 = 3$	(b) $(1/2)y = 7$	(c) $x/4 = 1$
(d) $(1/4)m = 3$	(e) $7 = x/5$	(f) $4 = (1/5)p$

13.1.5 Solve the following linear equations:

(a) $x/3 - 1 = 4$	(b) $x/5 + 2 = 1$	(c) $(2/3)x = 5$
(d) $(3/4)x = 6$	(e) $(1/5)x = 1/2$	(f) $2x/5 = 4$

13.1.6 Solve the following linear equations:

(a) $(x + 1)/2 = 3$	(b) $4 = (x - 2)/3$	(c) $(x - 10)/3 = 4$
(d) $8 = (5x - 1)/3$	(e) $2(x - 5)/3 = 2$	(f) $3(x - 2)/4 = 4x - 8$

13.1.7 Solve the following linear equations:

(a) $6 = 2(y - 1)/3$	(b) $2(x + 1) = 3(x - 5)$	(c) $5(x - 4) = 3(x + 2)$
(d) $(3 + y)/2 = (y + 1)/4$	(e) $(7 + 2x)/3 = (9x - 1)/7$	(f) $(2x + 3)/4 = (4x - 2)/6$

Exercise 13.2 · Constructing equations

13.2.1 In questions 1–3: (i) construct an equation in terms of x, (ii) solve the equation, (iii) calculate the size of each of the angles, (iv) check your answers. Each triangle in the book's diagram has these three angles:

(a) $x°$, $(x + 40)°$ and $(x + 20)°$ [4]

(b) $(x + 20)°$, $(x + 20)°$ and $(x - 40)°$ [4]

(c) $(5x)°$, $(11x)°$ and $(2x)°$ [4]

(d) $x°$, $(3x)°$ and $(2x)°$ [4]

(e) $(x - 20)°$, $(4x + 10)°$ and $(2x - 20)°$ [4]

(f) $(2x + 5)°$, $(4x)°$ and $(3x - 50)°$ [4]

13.2.2 In each diagram, straight lines meet at a point and these angles make a full turn around it:

(a) $(3x)°$, $(5x)°$ and $(4x)°$ [4]

(b) $(3x)°$, $(4x + 15)°$ and $(4x + 15)°$ [4]

(c) $(2x + 40)°$, $(x + 10)°$, $(3x + 5)°$ and $(6x + 5)°$ [4]

(d) x°, (3x − 5)°, (3x + 20)° and (3x + 15)° [4]

13.2.3 Each quadrilateral in the book's diagram has these four angles:

(a) x°, (4x)°, (3x − 40)° and (3x − 40)° [4]

(b) (3x)°, (3x + 40)°, (3x + 5)° and (x + 15)° [4]

(c) (5x − 10)°, (5x + 10)°, (2x)° and (4x + 8)° [4]

(d) x°, (4x − 10)°, (3x + 15)° and (x + 20)° [4]

(e) A parallelogram (arrows mark both pairs of parallel sides). Two angles next to each other along one side are $(x + 23)°$ and $(5x - 5)°$. [4]

13.2.4 By constructing an equation and solving it, find the value of x in each of these isosceles triangles (the equal sides are marked in the book):

(a) The angle between the two equal sides is $x°$; one base angle is $(4x)°$. [2]

(b) The two base angles are $(3x)°$ and $(x + 50)°$. [2]

(c) The two equal sides are $5x$ and $3x + 28$. [2]

(d) The angle between the two equal sides is $100°$; one base angle is $(2x - 10)°$. [2]

(e) The two equal sides are $2x + 40$ and $6x - 84$. [2]

(f) The angle between the two equal sides is x°; one base angle is 70°. [2]

13.2.5 Using angle properties, calculate the value of x in each of these questions. In each diagram two straight lines cross, and the two angles given are vertically opposite each other.

(a) (x + 50)° and (2x)° [2]

(b) (7x − 10)° and (3x + 42)° [2]

(c) (3x + 40)° and (4x)° [2]

(d) (4x − 55)° and (2x + 25)° [2]

13.2.6 Calculate the value of x. Each rectangle has the side lengths and area given.

(a) 4 by x + 1, area = 24	(b) 7 by x + 9, area = 77	(c) 4.5 by x + 3, area = 45
(d) 3.8 by x + 0.4, area = 5.7	(e) 0.2 by x + 0.5, area = 5.1	(f) x by 2x, area = 450

Exercise 13.3 · Simultaneous equations

13.3.1 Solve the following simultaneous equations either by elimination or by substitution: (a) x + y = 6 and x − y = 2 · (b) x + y = 11 and x − y − 1 = 0 · (c) x + y = 5 and x − y = 7 · (d) 2x + y = 12 and 2x − y = 8 · (e) 3x + y = 17 and 3x − y = 13 · (f) 5x + y = 29 and 5x − y = 11 [12]

13.3.2 (a) $3x + 2y = 13$ and $4x = 2y + 8$ · (b) $6x + 5y = 62$ and $4x - 5y = 8$ · (c) $x + 2y = 3$ and $8x - 2y = 6$ · (d) $9x + 3y = 24$ and $x - 3y = -14$ · (e) $7x - y = -3$ and $4x + y = 14$ · (f) $3x = 5y + 14$ and $6x + 5y = 58$ **[12]**

13.3.3 (a) $2x + y = 14$ and $x + y = 9$ · (b) $5x + 3y = 29$ and $x + 3y = 13$ · (c) $4x + 2y = 50$ and $x + 2y = 20$ · (d) $x + y = 10$ and $3x = -y + 22$ · (e) $2x + 5y = 28$ and $4x + 5y = 36$ · (f) $x + 6y = -2$ and $3x + 6y = 18$ **[12]**

13.3.4 (a) $x - y = 1$ and $2x - y = 6$ · (b) $3x - 2y = 8$ and $2x - 2y = 4$ · (c) $7x - 3y = 26$ and $2x - 3y = 1$ · (d) $x = y + 7$ and $3x - y = 17$ · (e) $8x - 2y = -2$ and $3x - 2y = -7$ · (f) $4x - y = -9$ and $7x - y = -18$ **[12]**

13.3.5 (a) $x + y = -7$ and $x - y = -3$ · (b) $2x + 3y = -18$ and $2x = 3y + 6$ · (c) $5x - 3y = 9$ and $2x + 3y = 19$ · (d) $7x + 4y = 42$ and $9x - 4y = -10$ · (e) $4x - 4y = 0$ and $8x + 4y = 12$ · (f) $x - 3y = -25$ and $5x - 3y = -17$ [12]

13.3.6 (a) $2x + 3y = 13$ and $2x - 4y + 8 = 0$ · (b) $2x + 4y = 50$ and $2x + y = 20$ · (c) $x + y = 10$ and $3y = 22 - x$ · (d) $5x + 2y = 28$ and $5x + 4y = 36$ · (e) $2x - 8y = 2$ and $2x - 3y = 7$ · (f) $x - 4y = 9$ and $x - 7y = 18$ [12]

13.3.7 (a) $-4x = 4y$ and $4x - 8y = 12$ · (b) $3x = 19 + 2y$ and $-3x + 5y = 5$ · (c) $3x + 2y = 12$ and $-3x + 9y = -12$ · (d) $3x + 5y = 29$ and $3x + y = 13$ · (e) $-5x + 3y = 14$ and $5x + 6y = 58$ · (f) $-2x + 8y = 6$ and $2x = 3 - y$ [12]

Exercise 13.4 · Further simultaneous equations

13.4.1 Solve the following: (a) $2x + y = 7$ and $3x + 2y = 12$ · (b) $5x + 4y = 21$ and $x + 2y = 9$ · (c) $x + y = 7$ and $3x + 4y = 23$ · (d) $2x - 3y = -3$ and $3x + 2y = 15$ · (e) $4x = 4y + 8$ and $x + 3y = 10$ · (f) $x + 5y = 11$ and $2x - 2y = 10$ [12]

13.4.2 (a) $x + y = 5$ and $3x - 2y + 5 = 0$ · (b) $2x - 2y = 6$ and $x - 5y = -5$ · (c) $2x + 3y = 15$ and $2y = 15 - 3x$ · (d) $x - 6y = 0$ and $3x - 3y = 15$ · (e) $2x - 5y = -11$ and $3x + 4y = 18$ · (f) $x + y = 5$ and $2x - 2y = -2$ [12]

13.4.3 (a) $3y = 9 + 2x$ and $3x + 2y = 6$ · (b) $x + 4y = 13$ and $3x - 3y = 9$ · (c) $2x = 3y - 19$ and $3x + 2y = 17$ · (d) $2x - 5y = -8$ and $-3x - 2y = -26$ · (e) $5x - 2y = 0$ and $2x + 5y = 29$ · (f) $8y = 3 - x$ and $3x - 2y = 9$ [12]

13.4.4 (a) $4x + 2y = 5$ and $3x + 6y = 6$ · (b) $4x + y = 14$ and $6x - 3y = 3$ · (c) $10x - y = -2$ and $-15x + 3y = 9$ · (d) $-2y = 0.5 - 2x$ and $6x + 3y = 6$ · (e) $x + 3y = 6$ and $2x - 9y = 7$ · (f) $5x - 3y = -0.5$ and $3x + 2y = 3.5$ [12]

Exercise 13.5 · Problems with simultaneous equations

13.5.1 The sum of two numbers is 17 and their difference is 3. Find the two numbers by forming two equations and solving them simultaneously. [3]

13.5.2 The difference between two numbers is 7. If their sum is 25, find the two numbers by forming two equations and solving them simultaneously. [3]

13.5.3 Find the values of x and y. (The book's diagram is a rectangle: the top side is $x + 3y$ and the bottom side is 13; the left side is $3x + y$ and the right side is 7.) [4]

13.5.4 Find the values of x and y. (The book's diagram is a rectangle: the top side is $3x - 2y$ and the bottom side is 11; the left side is $2x - 3y$ and the right side is 4.) [4]

13.5.5 A man's age is three times his son's age. Ten years ago he was five times his son's age. By forming two equations and solving them simultaneously, find both of their ages. [4]

13.5.6 A grandfather is ten times older than his granddaughter. He is also 54 years older than her. How old is each of them? [3]

Exercise 13.6 · Constructing further equations

13.6.1 Calculate the value of x. Each shape is drawn in the book with right-angled corners unless stated; the labelled sides are listed.

(a) An L-shape: top side x + 3, the right-hand side x, the side at the step x, the left-hand side x + 5; perimeter = 44 [2]

(b) An L-shape: top side 2x, the tall inner side 3x, the step 2x + 5, the left-hand side 8; perimeter = 68 [2]

(c) An L-shape: top side x, the inner side x, the right-hand side 3x, the bottom side 5x; perimeter = 108 [2]

(d) A rectangle with a small square notch cut from its bottom-left corner: top side 5x − 10, right-hand side 6x + 3, both sides of the notch x; perimeter = 140 [2]

(e) An L-shape: the left-hand side 7x, the short right-hand side 3x, the step 3x, the bottom side 12; perimeter = 224 [2]

(f) A four-sided shape with a long side of 4x and 60° angles at both ends of it. The other three sides are marked equal, and one of them is 2x; perimeter = 150 [2]

13.6.2 Form an equation and solve it:

(a) A number is trebled and then 7 is added to it. If the total is 28, find the number. [2]

(b) Multiply a number by 4 and then add 5 to it. If the total is 29, find the number. [2]

(c) If 31 is the result of adding 1 to 5 times a number, find the number. [2]

(d) Double a number and then subtract 9. If the answer is 11, what is the number? [2]

(e) If 9 is the result of subtracting 12 from 7 times a number, find the number. [2]

13.6.3 Form an equation and solve it:

(a) Add 3 to a number and then double the result. If the total is 22, find the number. [2]

(b) 27 is the answer when you add 4 to a number and then treble it. What is the number? [2]

(c) Subtract 1 from a number and multiply the result by 5. If the answer is 35, what is the number? [2]

(d) Add 3 to a number. If the result of multiplying this total by 7 is 63, find the number. [2]

(e) Add 3 to a number. Quadruple the result. If the answer is 36, what is the number? [2]

13.6.4 Form an equation and solve it:

(a) Gabriella is x years old. Her brother is 8 years older and her sister is 12 years younger than she is. If their total age is 50 years, how old are they? [3]

(b) A series of mathematics textbooks consists of four volumes. The first volume has x pages, the second has 54 pages more. The third and fourth volume each have 32 pages more than the second. If the total number of pages in all four volumes is 866, calculate the number of pages in each of the volumes. [4]

(c) The five interior angles (in °) of a pentagon are x, x + 30, 2x, 2x + 40 and 3x + 20. The sum of the interior angles of a pentagon is 540°. Calculate the size of each of the angles. [4]

(d) A hexagon consists of three interior angles of equal size and a further three which are double this size. The sum of all six angles is 720°. Calculate the size of each of the angles. [3]

(e) Four of the exterior angles of an octagon are the same size. The other four are twice as big. If the sum of the exterior angles is 360°, calculate the size of the interior angles. [4]

Exercise 13.7 · Quadratic equations by factorising (Extended)

13.7.1 Solve the following quadratic equations by factorising:

(a) $x^2 + 7x + 12 = 0$	(b) $x^2 + 8x + 12 = 0$	(c) $x^2 + 13x + 12 = 0$
(d) $x^2 - 7x + 10 = 0$	(e) $x^2 - 5x + 6 = 0$	(f) $x^2 - 6x + 8 = 0$

13.7.2 Solve:

(a) $x^2 + 3x - 10 = 0$	(b) $x^2 - 3x - 10 = 0$	(c) $x^2 + 5x - 14 = 0$
(d) $x^2 - 5x - 14 = 0$	(e) $x^2 + 2x - 15 = 0$	(f) $x^2 - 2x - 15 = 0$

13.7.3 Solve:

(a) $x^2 + 5x = -6$	(b) $x^2 + 6x = -9$	(c) $x^2 + 11x = -24$
(d) $x^2 - 10x = -24$	(e) $x^2 + x = 12$	(f) $x^2 - 4x = 12$

13.7.4 Solve:

(a) $x^2 - 2x = 8$	(b) $x^2 - x = 20$	(c) $x^2 + x = 30$
(d) $x^2 - x = 42$	(e) $x^2 - 2x = 63$	(f) $x^2 + 3x = 54$

Exercise 13.8 · More quadratic equations (Extended)

13.8.1 Solve the following quadratic equations:

(a) $x^2 - 9 = 0$	(b) $x^2 - 16 = 0$	(c) $x^2 = 25$
(d) $x^2 = 121$	(e) $x^2 - 144 = 0$	(f) $x^2 - 220 = 5$

13.8.2 Solve:

(a) $4x^2 - 25 = 0$	(b) $9x^2 - 36 = 0$	(c) $25x^2 = 64$

(a) $4x^2 - 25 = 0$	(b) $9x^2 - 36 = 0$	(c) $25x^2 = 64$
(d) $x^2 = 1/4$	(e) $x^2 - 1/9 = 0$	(f) $16x^2 - 1/25 = 0$

13.8.3 Solve:

(a) $x^2 + 5x + 4 = 0$	(b) $x^2 + 7x + 10 = 0$	(c) $x^2 + 6x + 8 = 0$
(d) $x^2 - 6x + 8 = 0$	(e) $x^2 - 7x + 10 = 0$	(f) $x^2 + 2x - 8 = 0$

13.8.4 Solve:

(a) $x^2 - 3x - 10 = 0$	(b) $x^2 + 3x - 10 = 0$	(c) $x^2 - 3x - 18 = 0$
(d) $x^2 + 3x - 18 = 0$	(e) $x^2 - 2x - 24 = 0$	(f) $x^2 - 2x - 48 = 0$

13.8.5 Solve:

(a) $x^2 + x = 12$	(b) $x^2 + 8x = -12$	(c) $x^2 + 5x = 36$
(d) $x^2 + 2x = -1$	(e) $x^2 + 4x = -4$	(f) $x^2 + 17x = -72$

13.8.6 Solve:

(a) $x^2 - 8x = 0$	(b) $x^2 - 7x = 0$	(c) $x^2 + 3x = 0$
(d) $x^2 + 4x = 0$	(e) $x^2 - 9x = 0$	(f) $4x^2 - 16x = 0$

13.8.7 Solve:

(a) $2x^2 + 5x + 3 = 0$	(b) $2x^2 - 3x - 5 = 0$	(c) $3x^2 + 2x - 1 = 0$
(d) $2x^2 + 11x + 5 = 0$	(e) $2x^2 - 13x + 15 = 0$	(f) $12x^2 + 10x - 8 = 0$

13.8.8 Solve:

(a) $x^2 + 12x = 0$	(b) $x^2 + 12x + 27 = 0$	(c) $x^2 + 4x = 32$

(a) $x^2 + 12x = 0$	(b) $x^2 + 12x + 27 = 0$	(c) $x^2 + 4x = 32$
(d) $x^2 + 5x = 14$	(e) $2x^2 = 72$	(f) $3x^2 - 12 = 288$

Exercise 13.9 · Constructing quadratic equations (Extended)

13.9.1 In the following questions, construct equations from the information given and then solve to find the unknown. When a number x is added to its square, the total is 12. Find two possible values for x. [3]

13.9.2 A number x is equal to its own square minus 42. Find two possible values for x. [3]

13.9.3 If the area of the rectangle (below) is 10 cm^2, calculate the only possible value for x. (The rectangle is (x + 3) cm long and x cm wide.) [3]

13.9.4 If the area of the rectangle (below) is 52 cm^2, calculate the only possible value for x. (The rectangle is (x + 9) cm long and x cm wide.) [3]

13.9.5 A triangle has a base length of 2x cm and a height of (x − 3) cm. If its area is 18 cm^2, calculate its height and base length. [4]

13.9.6 A triangle has a base length of $(x - 8)$ cm and a height of $2x$ cm. If its area is 20 cm^2, calculate its height and base length. [4]

13.9.7 A right-angled triangle has a base length of x cm and a height of $(x - 1)$ cm. If its area is 15 cm^2, calculate the base length and height. [4]

13.9.8 A rectangular garden has a square flower bed of side length x m in one of its corners. The remainder of the garden consists of lawn and has dimensions as shown (below). If the total area of the lawn is 50 m^2: (In the book's diagram the garden's long side is 7 m + x m, and its short side is x m + 2 m; the square bed of side x m sits in the top-right corner.)

(a) form an equation in terms of x, [2]

(b) solve the equation, [2]

(c) calculate the length and width of the whole garden. [2]

Exercise 13.10 · The quadratic formula and completing the square (Extended)

13.10.1 Solve the following quadratic equations using either the quadratic formula or by completing the square. Give your answers to 2 d.p. (a) $x^2 - x - 13 = 0$ · (b) $x^2 + 4x - 11 = 0$ · (c) $x^2 + 5x - 7 = 0$ · (d) $x^2 + 6x + 6 = 0$ · (e) $x^2 + 5x - 13 = 0$ · (f) $x^2 - 9x + 19 = 0$ **[12]**

13.10.2 (a) $x^2 + 7x + 9 = 0$ · (b) $x^2 - 35 = 0$ · (c) $x^2 + 3x - 3 = 0$ · (d) $x^2 - 5x - 7 = 0$ · (e) $x^2 + x - 18 = 0$ · (f) $x^2 - 8 = 0$ **[12]**

13.10.3 (a) $x^2 - 2x - 2 = 0$ · (b) $x^2 - 4x - 11 = 0$ · (c) $x^2 - x - 5 = 0$ · (d) $x^2 + 2x - 7 = 0$ · (e) $x^2 - 3x + 1 = 0$ · (f) $x^2 - 8x + 3 = 0$ **[12]**

13.10.4 (a) $2x^2 - 3x - 4 = 0$ · (b) $4x^2 + 2x - 5 = 0$ · (c) $5x^2 - 8x + 1 = 0$ · (d) $-2x^2 - 5x - 2 = 0$ · (e) $3x^2 - 4x - 2 = 0$ · (f) $-7x^2 - x + 15 = 0$ **[12]**

Exercise 13.11 · One linear and one non-linear equation (Extended)

13.11.1 Solve the following equations simultaneously: $y = 4$ and $y = (x - 3)^2 + 4$ **[3]**

13.11.2 $y = -2x - 3$ and $y = x^2 + 5x + 3$ **[3]**

13.11.3 $y = 2x^2 + 4x + 1$ and $y = 3x + 11$ **[3]**

13.11.4 $y = 6x^2 - 5x + 2$ and $y = 5x + 6$ **[3]**

13.11.5 $y = -2x + 2$ and $y = 2(x - 3)^2 - 16$ [3]

13.11.6 $y = -5x^2 - 5x + 10$ and $y = 6x - 2$ [3]

13.11.7 $y = 11 - x$ and $y = 30/x$ [3]

13.11.8 $y = 2x - 7 - 3/x$ and $y = 2/x$ [3]

13.11.9 Two rectangles are shown below. (Rectangle A is $(3x - 1)$ by $(2x + 1)$. Rectangle B is $(2x + 1)$ by $(x + 1/2)$.) Calculate the value of x if the area of rectangle A and the perimeter of rectangle B have the same numerical value. [4]

13.11.10 Two circles are shown below. (Circle A has radius $3p - 1$. Circle B has radius $p + 2$.) Calculate the value of p if the area of circle A has the same numerical value as the perimeter of circle B. Give your answer correct to 2 d.p. [4]

Exercise 13.12 · Linear inequalities (Extended)

13.12.1 Solve the following inequalities and illustrate your solution on a number line:

(a) $x + 3 < 7$	(b) $5 + x > 6$	(c) $4 + 2x \leq 10$
(d) $8 \leq x + 1$	(e) $5 > 3 + x$	(f) $7 < 3 + 2x$

13.12.2 Solve and illustrate each solution on a number line:

(a) $x - 3 < 4$	(b) $x - 6 \geq -8$	(c) $8 + 3x > -1$
(d) $5 \geq -x - 7$	(e) $12 > -x - 12$	(f) $4 \leq 2x + 10$

13.12.3 Solve and illustrate each solution on a number line:

(a) $x/2 < 1$	(b) $4 \geq x/3$	(c) $1 \leq x/2$
(d) $9x \geq -18$	(e) $-4x + 1 < 3$	(f) $1 \geq -3x + 7$

Exercise 13.13 · Double inequalities (Extended)

13.13.1 Find the range of values for which the following inequalities are satisfied. Illustrate each solution on a number line:

(a) $4 < 2x \leq 8$	(b) $3 \leq 3x < 15$	(c) $7 \leq 2x < 10$	(d) $10 \leq 5x < 21$

13.13.2 Solve and illustrate each solution on a number line:

(a) $5 < 3x + 2 \leq 17$	(b) $3 \leq 2x + 5 < 7$	(c) $12 < 8x - 4 < 20$	(d) $15 \leq 3(x - 2) < 9$

Student assessment 1

SA1.1 Solve the following equations:

(a) $y + 9 = 3$	(b) $3x - 5 = 13$	(c) $12 - 5p = -8$	(d) $2.5y + 1.5 = 7.5$

SA1.2 Solve:

(a) $5 - p = 4 + p$	(b) $8m - 9 = 5m + 3$	(c) $11p - 4 = 9p + 15$	(d) $27 - 5r = r - 3$

SA1.3 Solve:

(a) $p/(-2) = -3$	(b) $6 = (2/5)x$	(c) $(m - 7)/5 = 3$	(d) $(4t - 3)/3 = 7$

SA1.4 Solve:

(a) $(2/5)(t - 1) = 3$	(b) $5(3 - m) = 4(m - 6)$	(c) $5 = (2/3)(x - 1)$	(d) $(4/5)(t - 2) = (1/4)(2t + 8)$

SA1.5 Solve the following simultaneous equations: (a) $x + y = 11$ and $x - y = 3$ · (b) $5p - 3q = -1$ and $-2p - 3q = -8$ · (c) $3x + 5y = 26$ and $x - y = 6$ · (d) $2m - 3n = -9$ and $3m + 2n = 19$ [8]

SA1.6 Solve the following equations simultaneously: $y = -3x + 5$ and $y = 4x^2 + 8x + 2$ [4]

Student assessment 2

SA2.1 The angles of a quadrilateral are x, 3x, (2x − 40) and (3x − 50) degrees.

(a) Construct an equation in terms of x. [1]

(b) Solve the equation. [1]

(c) Calculate the size of the four angles. [2]

SA2.2 Three is subtracted from seven times a number. The result is multiplied by 5. If the answer is 55, calculate the value of the number by constructing an equation and solving it. [3]

SA2.3 The interior angles of a pentagon are 9x, 5x + 10, 6x + 5, 8x − 25 and 10x − 20 degrees. If the sum of the interior angles of a pentagon is 540°, find the size of each of the angles. [4]

SA2.4 Solve the following quadratic equation by factorisation: $x^2 - x = 20$ [3]

SA2.5 Solve the following quadratic equation by using the quadratic formula: $2x^2 - 7 = 3x$ [3]

SA2.6 Solve the following equations simultaneously: $y = 2/x + 1$ and $y = (1/2)x + 2$ [4]

SA2.7 Solve the inequality below and illustrate your answer on a number line. $6 < 2x \leq 10$ [2]

SA2.8 For what values of x is the following inequality true? $7/(x - 5) > 0$ [2]

Student assessment 3

SA3.1 The angles of a triangle are x°, y° and 40°. The difference between the two unknown angles is 30°.

(a) Write down two equations from the information given above. [2]

(b) What is the size of the two unknown angles? [2]

SA3.2 The interior angles of a pentagon increase by 10° as you progress clockwise.

(a) Illustrate this information in a diagram. [1]

(b) Write an expression for the sum of the interior angles. [1]

(c) The sum of the interior angles of a pentagon is 540°. Use this to calculate the largest **exterior** angle of the pentagon. [2]

(d) Illustrate on your diagram the size of each of the five exterior angles. [1]

(e) Show that the sum of the exterior angles is 360°. [1]

SA3.3 A flat sheet of card measures 12 cm by 10 cm. It is made into an open box by cutting a square of side x cm from each corner and then folding up the sides.

(a) Illustrate the box and its dimensions on a simple 3D sketch. [1]

(b) Write an expression for the surface area of the outside of the box. [2]

(c) If the surface area is 56 cm^2, form and solve a quadratic equation to find the value of x. [3]

SA3.4 (a) Show that $x - 2 = 4/(x - 3)$ can be written as $x^2 - 5x + 2 = 0$. [2]

(b) Use the quadratic formula to solve $x - 2 = 4/(x - 3)$. [3]

SA3.5 A right-angled triangle ABC has side lengths as follows: AB = x cm, AC is 2 cm shorter than AB, and BC is 2 cm shorter than AC.

(a) Illustrate this information on a diagram. [1]

(b) Using this information show that $x^2 - 12x + 20 = 0$. [2]

(c) Solve the above quadratic and hence find the length of each of the three sides of the triangle. [3]

Check yourself

C1 Solve $5(x - 3) = 2x + 9$. [2]

C2 Solve the simultaneous equations $2x + 3y = 12$ and $5x - 2y = 11$. [3]

C3 Solve $x^2 + x - 20 = 0$ by factorising. [2]

C4 Use the quadratic formula to solve $3x^2 - 5x - 1 = 0$. Give your answers to 2 d.p. [3]

C5 Solve $4 - 3x \geq 19$ and show the answer on a number line. [2]

C6 Write $x^2 + 6x - 4$ in the form $(x + p)^2 + q$, then solve $x^2 + 6x - 4 = 0$, leaving $\sqrt{}$ in your answer. [3]

Chapter quiz

Q1 Solve $3x + 8 = 14$.

A	B	C	D
$x = 2$	$x = 6$	$x = 22/3$	$x = -2$

Q2 Solve $4(x - 5) = 7(2x - 5)$.

A	B	C	D
$x = 1.5$	$x = -1.5$	$x = 5.5$	$x = 0.15$

Q3 A triangle has angles $(x + 30)°$, $(x - 30)°$ and $90°$. What is x?

A	B	C	D
30	45	60	90

Q4 Solve $x + y = 8$ and $4x + y = 23$.

A	B	C	D
$x = 5, y = 3$	$x = 3, y = 5$	$x = 4, y = 4$	$x = 6, y = 2$

Q5 To eliminate y from $5x - 3y = 1$ and $3x + 4y = 18$, multiply the equations by...

A	B	C	D
4 and 3	3 and 4	5 and 3	3 and 5

Q6 Solve $x^2 - x - 12 = 0$.

A	B	C	D
$x = 4$ or $x = -3$	$x = -4$ or $x = 3$	$x = 12$ or $x = -1$	$x = 6$ or $x = -2$

Q7 Solve $x^2 - 6x = 0$.

A	B	C	D
$x = 6$ only	$x = 0$ or $x = 6$	$x = 0$ or $x = -6$	$x = \sqrt{6}$ or $x = -\sqrt{6}$

Q8 For $x^2 - 4x - 2 = 0$, what is the discriminant $b^2 - 4ac$?

A	B	C	D
8	24	12	−8

Q9 $x^2 + 2x + 5 = 0$ has discriminant -16. How many real solutions does it have?

A	B	C	D
None	One	Two	Infinitely many

Q10 Which is $x^2 - 4x - 2$ written by completing the square?

A	B	C	D
$(x - 2)^2 - 6$	$(x - 2)^2 - 2$	$(x - 4)^2 - 2$	$(x + 2)^2 - 6$

Q11 Solve $9 - 4x \geq 17$.

A	B	C	D
$x \leq -2$	$x \geq -2$	$x \leq 2$	$x \geq 2$

Q12 Which number line shows $x > 2$?

A	B	C	D
Open circle at 2, arrow right	Filled circle at 2, arrow right	Open circle at 2, arrow left	Filled circle at 2, arrow left

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End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/o-level-mathematics/chapter-13-equations-and-inequalities/