CHAPTER 2
Quadratic equations

UNIT 1: Equations already in factorised form

QUESTION 1 Solve the following quadratic equations that are already expressed in factorised form.

a $(x-1)(x-2)=0$

b $(x-2)(x+3)=0$

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

d $x(x+5)=0$

e $2x(x-4)=0$

f $x(2x-1)=0$

g $(x-3)(x-5)=0$

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

i $(x+2)(x-4)=0$

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

k $(x-2)(x+2)=0$

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

m $(x+6)(2x-1)=0$

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

o $(x-2)(3x-1)=0$

QUESTION 2 Solve the following quadratic equations.

a $(x-3)(x-7)=0$

b $(x+1)(x-6)=0$

c $(3x-2)(x+1)=0$

d $x(x+8)=0$

e $5x(2x-1)=0$

f $3x(x-2)=0$

g $(x+2)(x+3)=0$

h $4x(2x-5)=0$

i $-2x(x-1)=0$

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

k $(x-3)^2=0$

l $3x(x-3)=0$

QUESTION 3 Solve the following equations.

a $(x-4)(x-5)=0$

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

c $x(x-3)=0$

d $(2x-1)(x+4)=0$

e $(2x+3)(2x-3)=0$

f $2x(x-2)=0$

g $(x-7)(x-9)=0$

h $(4x+5)(5x-4)=0$

i $(x+1)(x-5)=0$

Quadratic equations

UNIT 2: Equations involving the difference between two squares

QUESTION 1 Solve the following quadratic equations.

a $x^2 - 4 = 0$

b $x^2 - 36 = 0$

c $x^2 - 9 = 0$

d $x^2 - 1 = 0$

e $x^2 - 49 = 0$

f $x^2 - 16 = 0$

g $x^2 - 25 = 0$

h $x^2 - 64 = 0$

i $x^2 - 81 = 0$

j $x^2 - 100 = 0$

k $x^2 - 121 = 0$

l $x^2 - 144 = 0$

QUESTION 2 Solve the following equations.

a $4x^2 - 25 = 0$

b $9x^2 - 16 = 0$

c $16x^2 - 25 = 0$

d $x^2 - 2\frac{1}{4} = 0$

e $9x^2 - 1 = 0$

f $3x^2 - 3 = 0$

g $9 - x^2 = 0$

h $2x^2 - 18 = 0$

i $4x^2 - 9 = 0$

j $25x^2 - 36 = 0$

k $5x^2 - 20 = 0$

l $(x+5)^2 - 4 = 0$

m $x^2 - 2 = 0$

n $x^2 - 7 = 0$

o $x^2 - 5 = 0$

Quadratic equations

UNIT 3: Equations involving a common factor

QUESTION **1** Solve the following quadratic equations.

a $x^2 - 5x = 0$

b $x^2 - 4x = 0$

c $x^2 - 2x = 0$

d $x^2 + 7x = 0$

e $x^2 + 5x = 0$

f $x^2 + 9x = 0$

g $x^2 = 4x$

h $x^2 = 9x$

i $x^2 = 12x$

j $6x^2 - 12x = 0$

k $x^2 + 8x = 0$

l $x^2 - 10x = 0$

m $3x^2 + 21x = 0$

n $5x^2 - x = 0$

o $4x^2 = -12x$

QUESTION **2** Solve the following equations.

a $6x^2 - 24x = 0$

b $5x^2 + 25x = 0$

c $5x^2 - 3x = 0$

d $8x^2 - 16x = 0$

e $3x^2 - 3x = 0$

f $6x^2 - 6x = 0$

g $6x^2 + 2x = 0$

h $3x^2 - 7x = 0$

i $9x^2 - 9x = 0$

j $7x^2 - 21x = 0$

k $9x^2 - 27x = 0$

l $8x^2 - 4x = 0$

Quadratic equations

UNIT 4: Factorising a quadratic trinomial

QUESTION 1 Solve the following quadratic equations by factorising.

a $x^2 + 5x + 6 = 0$

b $x^2 - 2x - 35 = 0$

c $x^2 + 5x - 6 = 0$

d $x^2 + 7x + 12 = 0$

e $x^2 - 5x + 6 = 0$

f $x^2 + 2x - 48 = 0$

g $x^2 - 8x + 16 = 0$

h $x^2 + 2x - 15 = 0$

i $x^2 = 3x + 18$

j $x^2 + 40 = 13x$

k $x^2 + 5x = 36$

l $x^2 = 15x - 54$

QUESTION 2 Factorise and solve the following quadratic equations.

a $2x^2 + 11x + 12 = 0$

b $3x^2 - 8x + 4 = 0$

c $6x^2 + 5x - 6 = 0$

d $2x^2 + x - 15 = 0$

e $6x^2 + 5x - 6 = 0$

f $2x^2 + 5x - 42 = 0$

g $6x^2 + x - 1 = 0$

h $4x^2 + 8x - 5 = 0$

i $x(2x + 7) = -6$

j $2x^2 = 3(x + 3)$

k $6x^2 = 20 - 7x$

l $(x + 3)^2 = 7x + 11$

Quadratic equations

UNIT 5: Completing the square

QUESTION 1 What number must be added to make each of the following a perfect square?

a $x^2 + 6x$ _____ **b** $x^2 - 10x$ _____ **c** $x^2 + 9x$ _____

d $x^2 + 8x$ _____ **e** $x^2 + 5x$ _____ **f** $x^2 + 14x$ _____

g $x^2 - 12x$ _____ **h** $x^2 - 14x$ _____ **i** $x^2 - 18x$ _____

j $x^2 - 7x$ _____ **k** $x^2 - 3x$ _____ **l** $x^2 + 11x$ _____

m $x^2 - 6x + \ldots^2 = (x - \ldots)^2$ **n** $x^2 + 4x + \ldots^2 = (x + \ldots)^2$ **o** $x^2 - 2x + \ldots^2 = (x - \ldots)^2$

_____ _____ _____

p $x^2 + 10x + \ldots^2 = (x + \ldots)^2$ **q** $x^2 + 3x + \ldots^2 = (x + \ldots)^2$ **r** $x^2 - 7x + \ldots^2 = (x - \ldots)^2$

_____ _____ _____

QUESTION 2 Solve the following quadratic equations by completing the square.

a $x^2 + 5x + 4 = 0$ **b** $x^2 + 6x + 4 = 0$ **c** $x^2 - 8x + 1 = 0$

d $x^2 + 9x = 4$ **e** $x^2 + 7x + 6 = 0$ **f** $x^2 = 8x + 9$

g $x^2 = 5x + 6$ **h** $x^2 + 10x = 5$ **i** $x^2 + 3x = 4$

j $x^2 + 4x = -4$ **k** $x^2 + 12x - 8 = 0$ **l** $x^2 - 10x = 3$

Quadratic equations

UNIT 6: The quadratic formula

QUESTION 1 Solve the following equations using the quadratic formula. Leave your answer in surd form.

a $x^2 + 4x + 3 = 0$

b $2x^2 + 7x + 3 = 0$

c $2x^2 + 7x - 4 = 0$

d $10x^2 + 7x - 12 = 0$

e $x^2 - x - 1 = 0$

f $3x^2 + 8x + 5 = 0$

g $2x^2 - 8x - 3 = 0$

h $5x^2 - 9x - 1 = 0$

i $8x^2 + 5x - 2 = 0$

j $3x^2 + 10x - 5 = 0$

k $x(x + 6) = 35$

l $(x - 8)^2 = 15$

QUESTION 2 Use the quadratic formula to solve. Give your answer correct to two decimal places.

a $2x^2 - 3x - 2 = 0$

b $x^2 - 3x + 1 = 0$

c $x^2 + 6x + 9 = 0$

d $x^2 + 6x + 2 = 0$

e $x^2 + 4x = -4$

f $x^2 - 5x = -7$

g $x^2 - 3x + 2 = 4x + 5$

h $x = \dfrac{3x + 7}{x}$

i $x(x - 7) = 5$

Quadratic equations

UNIT 7: Mixed quadratic equations

QUESTION 1 Solve the following quadratic equations by any suitable method. Give your answer correct to one decimal place.

a $x^2 + 13x + 42 = 0$

b $6x^2 - 5x - 1 = 0$

c $4x^2 + 11x + 6 = 0$

d $2x^2 - 9x - 5 = 0$

e $24x^2 - 13x - 7 = 0$

f $2x^2 - 11x - 63 = 0$

g $3x^2 = 5 - 2x$

h $x^2 + 7x + 8 = 0$

i $x^2 + 3x = -2$

j $3x^2 - 11x + 8 = 0$

k $x^2 - 7x = 3$

l $x^2 + 10x - 75 = 0$

QUESTION 2 Solve the following quadratic equations. Give your answer correct to two decimal places

a $(2x + 5)^2 = (x + 1)(x + 2)$

b $\frac{2}{x} + 3x = 5$

c $x = \frac{8}{8 + x}$

d $7x^2 + 9x - 3 = 0$

e $x^2 - 7x - 2 = 0$

f $10x^2 + 29x + 21 = 0$

g $4x^2 + 21x - 49 = 0$

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

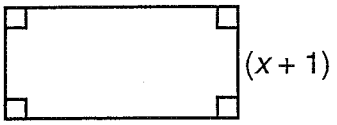
i $8x^2 - 9x - 4 = 0$

Quadratic equations

UNIT 8: Using quadratic equations to solve problems

QUESTION 1 In each of the following diagrams, find x. All measurements are in centimetres.

a



Area = 24 cm^2

b

Area = 9 cm^2

QUESTION 2

a Find the number which when added to its square gives twelve.

b The area of a rectangle is 15 cm^2 and its length is 2 cm longer than its width. Find the dimensions of the rectangle.

QUESTION 3

a When a number is subtracted from its square, the result is 30. Find the number.

b The square of a number is equal to nine times the number. What is the number?

c The sum of the squares of two consecutive positive integers is 25. Find the integers.

Quadratic equations

UNIT 9: Simultaneous equations resulting in a quadratic

QUESTION 1 Solve the following simultaneous equations.

a $x + y = 3$
$xy = 2$

b $x + y = 5$
$xy = 4$

c $y = x^2 + 3x + 7$
$y = x + 10$

d $y = x^2 + 15x + 12$
$y = x - 1$

QUESTION 2 Solve the following simultaneous equations.

a $x + y = 7$
$x^2 + y^2 = 85$

b $x + y = 4$
$x^2 + y^2 = 10$

c $y = x$
$y = x^2$

d $y = x + 3$
$y = x^2 - x$

QUESTION 3 Solve simultaneously.

a $3x + y = 9$
$y = x^2 - x - 6$

b $2x + y = 8$
$y = 6 - x^2 + x$

c $y = 2x$
$y = x^2$

d $y = 2x - 1$
$y = x^2$

Quadratic equations

Instructions for SECTION 1

- You have 15 minutes to answer Section 1
- Each question is worth 2 marks
- Attempt ALL questions
- Calculators are NOT to be used
- Fill in only ONE CIRCLE for each question

Marks

1 If $(x+2)(x-3)=0$ then the value of x is

Ⓐ 2 or –3 Ⓑ –2 or –3 Ⓒ 2 or 3 Ⓓ –2 or 3 — 2

2 If $x(x-2)=0$ then the value of x is

Ⓐ 2 Ⓑ –2 Ⓒ 0 or 2 Ⓓ 0 or –2 — 2

3 If $x^2-9=0$ then the value of x is

Ⓐ 0 Ⓑ 3 Ⓒ ± 3 Ⓓ 9 — 2

4 If $3x^2-48=0$ then the value of x is

Ⓐ 16 Ⓑ ± 4 Ⓒ 4 Ⓓ 0 — 2

5 If $(x-5)(4x-3)=0$ then the value of x is

Ⓐ 5 or $-\frac{3}{4}$ Ⓑ –5 or $\frac{3}{4}$ Ⓒ 5 or $\frac{3}{4}$ Ⓓ –5 or $-\frac{3}{4}$ — 2

6 If $x^2-x-5=0$ then the value of x is

Ⓐ $\frac{1\pm\sqrt{21}}{2}$ Ⓑ $\frac{-1\pm\sqrt{21}}{2}$ Ⓒ $\frac{1\pm\sqrt{19}}{2}$ Ⓓ $\frac{-1\pm\sqrt{19}}{2}$ — 2

7 Which is a factor of $2x^2-x-3$?

Ⓐ $2x-3$ Ⓑ $2x-1$ Ⓒ $2x+1$ Ⓓ $2x+3$ — 2

8 If $4y^2-12y+P=(2y+Q)^2$ then

Ⓐ $P=9, Q=-3$ Ⓑ $P=-9, Q=-3$ Ⓒ $P=9, Q=3$ Ⓓ $P=-9, Q=3$ — 2

9 Which one of the following is a perfect square for all values of x?

Ⓐ x^2+49 Ⓑ x^2-49 Ⓒ $x^2-14x+49$ Ⓓ $x^2+7x+49$ — 2

10 $(x-2)(x-3)=0$ is the same as

Ⓐ x^2+6 Ⓑ x^2+5x-6 Ⓒ x^2-5x+6 Ⓓ x^2-5x-6 — 2

Total marks achieved for SECTION 1 ___/20

UNIT 10: TOPIC TEST

SECTION 2

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Quadratic equations

Instructions for SECTION 2

- You have 20 minutes to answer ALL of Section 2
- Each question is worth 2 marks
- Attempt ALL questions
- Calculators may be used

Questions	Answers	Marks
Solve the following quadratic equations.		
1 $3x(x-5)=0$		2
2 $(x-4)(x-7)=0$		2
3 $(2x-1)^2=0$		2
4 $(3x+5)(x-2)=0$		2
5 $x^2-16=0$		2
6 $7x^2-28=0$		2
7 $x^2-15x=0$		2
8 $2x^2+9x-5=0$		2
9 $x^2-12x+27=0$		2
10 What must be added to x^2-6x to make it a perfect square?		2
11 Solve $x^2+4x-12=0$ by completing the square.		2
Solve the following equations using the quadratic formula.		
12 $x^2-2x-5=0$		2
13 $2x^2+7x-8=0$		2
14 Find the number which when added to its square gives 30.		2
15 Solve this pair of simultaneous equations: $x^2+y^2=10$ and $x+y=4$		2

Total marks achieved for SECTION 2 ___/3

Answers

Page 1 1 a $x=1$ or 2 b $x=2$ or -3 c $x=1$ or 3 d $x=0$ or -5 e $x=0$ or 4 f $x=0$ or $\frac{1}{2}$ g $x=3$ or 5 h $x=-1$ or 3 i $x=-2$ or 4 j $x=-3$ or 3 k $x=-2$ or 2 l $x=-5$ or 5 m $x=-6$ or $\frac{1}{2}$ n $x=-3$ or $\frac{1}{3}$ o $x=2$ or $\frac{1}{3}$ 2 a $x=3$ or 7 b $x=-1$ or 6 c $x=-1$ or $\frac{2}{3}$ d $x=0$ or -8 e $x=0$ or $\frac{1}{2}$ f $x=0$ or 2 g $x=-3$ or -2 h $x=0$ or $2\frac{1}{2}$ i $x=0$ or 1 j $x=0$ or $-\frac{1}{3}$ k $x=3$ l $x=0$ or 3 3 a $x=4$ or 5 b $x=8$ or -8 c $x=0$ or 3 d $x=-4$ or $\frac{1}{2}$ e $x=-1\frac{1}{2}$ or $1\frac{1}{2}$ f $x=0$ or 2 g $x=7$ or 9 h $x=-\frac{5}{4}$ or $\frac{4}{5}$ i $x=-1$ or 5

Page 2 1 a $x=2$ or -2 b $x=6$ or -6 c $x=3$ or -3 d $x=1$ or -1 e $x=7$ or -7 f $x=4$ or -4 g $x=5$ or -5 h $x=8$ or -8 i $x=9$ or -9 j $x=10$ or -10 k $x=11$ or -11 l $x=12$ or -12 2 a $x=2\frac{1}{2}$ or $-2\frac{1}{2}$ b $x=\frac{4}{3}$ or $-\frac{4}{3}$ c $x=\frac{5}{4}$ or $-\frac{5}{4}$ d $x=\frac{3}{2}$ or $-\frac{3}{2}$ e $x=\frac{1}{3}$ or $-\frac{1}{3}$ f $x=1$ or -1 g $x=3$ or -3 h $x=3$ or -3 i $x=\frac{3}{2}$ or $-\frac{3}{2}$ j $x=\frac{6}{5}$ or $-\frac{6}{5}$ k $x=2$ or -2 l $x=-3$ or -7 m $x=\sqrt{2}$ or $-\sqrt{2}$ n $x=\sqrt{7}$ or $-\sqrt{7}$ o $x=\sqrt{5}$ or $-\sqrt{5}$

Page 3 1 a $x=0$ or 5 b $x=0$ or 4 c $x=0$ or 2 d $x=0$ or -7 e $x=0$ or -5 f $x=0$ or -9 g $x=0$ or 4 h $x=0$ or 9 i $x=0$ or 12 j $x=0$ or 2 k $x=0$ or -8 l $x=0$ or 10 m $x=0$ or -7 n $x=0$ or $\frac{1}{5}$ o $x=0$ or -3 2 a $x=0$ or 4 b $x=0$ or -5 c $x=0$ or $\frac{3}{5}$ d $x=0$ or 2 e $x=0$ or 1 f $x=0$ or 1 g $x=0$ or $-\frac{1}{3}$ h $x=0$ or $\frac{7}{3}$ i $x=0$ or 1 j $x=0$ or 3 k $x=0$ or 3 l $x=0$ or $\frac{1}{2}$

Page 4 1 a $x=-3$ or -2 b $x=7$ or -5 c $x=-6$ or $+1$ d $x=-3$ or -4 e $x=2$ or 3 f $x=-8$ or 6 g $x=4$ h $x=3$ or -5 i $x=6$ or -3 j $x=5$ or 8 k $x=-9$ or 4 l $x=6$ or 9 2 a $x=-4$ or $-\frac{3}{2}$ b $x=2$ or $\frac{2}{3}$ c $x=\frac{2}{3}$ or $-\frac{3}{2}$ d $x=-3$ or $\frac{5}{2}$ e $x=\frac{2}{3}$ or $-\frac{3}{2}$ f $x=-6$ or $\frac{7}{2}$ g $x=-\frac{1}{2}$ or $\frac{1}{3}$ h $x=\frac{1}{2}$ or $-\frac{5}{2}$ i $x=-2$ or $-\frac{3}{2}$ j $x=-\frac{3}{2}$ or 3 k $x=\frac{4}{3}$ or $-\frac{5}{2}$ l $x=-1$ or 2

Page 5 1 a 9 b 25 c $\frac{81}{16}$ d 16 e $6\frac{1}{4}$ f 49 g 36 h 49 i 81 j $12\frac{1}{4}$ k $2\frac{1}{4}$ l $30\frac{1}{4}$ m 3 n 2 o 1 p 5 q $\frac{3}{2}$ r $\frac{7}{2}$ 2 a $x=-1$ or -4 b $x=-3\pm\sqrt{5}$ c $x=4\pm\sqrt{15}$ d $x=\frac{-9\pm\sqrt{97}}{2}$ e $x=-1$ or -6 f $x=-1$ or 9 g $x=-1$ or 6 h $x=-5\pm\sqrt{30}$ i $x=-4$ or 1 j $x=-2$ k $x=-6\pm2\sqrt{11}$ l $x=5\pm2\sqrt{7}$

Page 6 1 a $x=-1$ or -3 b $x=-3$ or $-\frac{1}{2}$ c $x=-4$ or $\frac{1}{2}$ d $x=+\frac{4}{5}$ or $-\frac{3}{2}$ e $x=\frac{1\pm\sqrt{5}}{2}$ f $x=-1$ or $-\frac{5}{3}$ g $x=\frac{4\pm\sqrt{22}}{2}$ h $x=\frac{9\pm\sqrt{101}}{10}$ i $x=\frac{-5\pm\sqrt{89}}{16}$ j $x=\frac{-5\pm2\sqrt{10}}{3}$ k $x=-3\pm2\sqrt{11}$ l $x=8\pm\sqrt{15}$ 2 a $x=2$ or $-\frac{1}{2}$ b $x=2.62$ or 0.38 c $x=-3$ d $x=-0.35$ or -5.65 e $x=-2$ f $x=6.14$ or -1.14 g $x=7.41$ or 0.41 h $x=4.54$ or -1.54 i $x=7.65$ or -0.65

Page 7 1 a $x=-6$ or -7 b $x=1$ or $-\frac{1}{6}$ c $x=-2$ or $-\frac{3}{4}$ d $x=5$ or $-\frac{1}{2}$ e $x=-\frac{1}{3}$ or $\frac{7}{8}$ f $x=-3\frac{1}{2}$ or 9 g $x=1$ or $1\frac{2}{3}$ $x=\frac{-7\pm\sqrt{17}}{2}$ h ~~$x=-1$ or 8~~ i $x=-1$ or -2 j $x=1$ or $2\frac{2}{3}$ k $x=7.4$ or -0.4 l $x=5$ or -15 2 a $x=-2.23$ or -3.43 b $x=1$ or $\frac{2}{3}$ c $x=0.90$ or -8.90 d $x=0.27$ or -1.56 e $x=7.27$ or -0.27 f $x=1.40$ or -1.50 g $x=1.75$ or -7 h $x=1$ or $1\frac{1}{2}$ i $x=1.47$ or -0.34

Page 8 1 a $x=3$ b $x=1$ 2 a $x=-4$ or 3 b $W=3$ cm and $L=5$ cm 3 a -5 or 6 b 9 c 3 and 4

Page 9 1 a $x=1, y=2$ or $x=2, y=1$ b $x=1, y=4$ or $x=4, y=1$ c $x=1, y=11$ or $x=-3, y=7$ d $x=-1, y=-2$ or $x=-13, y=-14$
2 a $x=9, y=-2$ or $x=-2, y=9$ b $x=1, y=3$ or $x=3, y=1$ c $x=0, y=0$ or $x=1, y=1$ d $x=-1, y=2$ or $x=3, y=6$
3 a $x=-5, y=24$ or $x=3, y=0$ b $x=1, y=6$ or $x=2, y=4$ c $x=0, y=0$ or $x=2, y=4$ d $x=1, y=1$

Page 10 1 D 2 C 3 C 4 B 5 C 6 A 7 A 8 A 9 C 10 C

Page 11 1 $x=0$ or 5 2 $x=4$ or 7 3 $x=\frac{1}{2}$ 4 $x=-\frac{5}{3}$ or 2 5 $x=4$ or -4 6 $x=2$ or -2 7 $x=0$ or 15 8 $x=-5$ or $\frac{1}{2}$ 9 $x=3$ or 9