DANEMATHICS
FREE CAPS MATHS RESOURCES

GRADE 11 · EQUATIONS AND INEQUALITIES

Solving Quadratic Equations: Factorising, Formula and Completing the Square

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
35	55 minutes	3

Name: ..... Class: .....

Date: .....

MARK ____ / 35

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 Solve for x: $x^2 - 5x + 6 = 0$ (1)

A) $x = 5$ or $x = 6$

B) $x = -2$ or $x = -3$

C) $x = 1$ or $x = 6$

D) $x = 2$ or $x = 3$ ✓

Answer: D — $(x - 2)(x - 3) = 0$, since $2 \times 3 = 6$ and $2 + 3 = 5$.

- **A** — read off b and c instead of factorising
- **B** — both factors are NEGATIVE, so the roots come out positive
- **C** — $1 \times 6 = 6$, but $1 + 6 = 7$, not 5

1.2 Solve for x: $x(2x + 6) = 0$ (1)

A) $x = -3$ only

B) $x = -6$ only

C) $x = 0$ or $x = -3$ ✓

D) $x = 0$ or $x = 3$

Answer: C — A product is zero when either factor is zero: $x = 0$, or $2x + 6 = 0$.

- **A** — left out the root $x = 0$
- **B** — did not divide the 6 by the 2, and dropped the $x = 0$ root
- **D** — $2x + 6 = 0$ gives $x = -3$, not $+3$

1.3 Solve for x, correct to TWO decimal places: $4x^2 = 9 - 3x$ (1)

A) $x = 1{,}50$ or $x = -1{,}50$

B) $x = 12{,}37$ or $x = -12{,}37$

C) **$x = 1{,}17$ or $x = -1{,}92$** ✓

D) $x = -1{,}17$ or $x = 1{,}92$

> **Answer: C** — $4x^2 + 3x - 9 = 0$, so $x = (-3 \pm \sqrt{153}) \div 8$.
> - **A** — solved $4x^2 = 9$ and ignored the $-3x$ term altogether
> - **B** — gave $\pm\sqrt{153}$ without subtracting b or dividing by $2a$
> - **D** — the formula starts with $-b$, which is -3, so the signs are the wrong way round

1.4 The quadratic formula is $x = \ldots$ (1)

A) $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{a}$

B) $\dfrac{-b \pm \sqrt{b^2 + 4ac}}{2a}$

C) $\dfrac{b \pm \sqrt{b^2 - 4ac}}{2a}$

D) $\dfrac{\boldsymbol{-b \pm \sqrt{b^2 - 4ac}}}{\boldsymbol{2a}}$ ✓

> **Answer: D** — That is the formula as it appears on the information sheet.
> - **A** — the denominator is $2a$, not a
> - **B** — the discriminant is $b^2 - 4ac$, with a MINUS
> - **C** — the formula begins with $-b$, not $+b$

1.5 Solve for x: $x^2 = 16$ (1)

A) $x = 8$

B) **$x = 4$ or $x = -4$** ✓

C) $x = 256$

D) $x = 4$ only

> **Answer: B** — Both 4^2 and $(-4)^2$ equal 16.
> - **A** — halved 16 instead of square-rooting it
> - **C** — squared 16 instead of square-rooting it
> - **D** — a square root has TWO values

1.6 Completing the square turns $x^2 + 6x = 7$ into ... (1)

A) $(x + 6)^2 = 43$

B) $(x + 3)^2 = 9$

C) **$(x + 3)^2 = 16$** ✓

D) $(x + 3)^2 = 7$

> **Answer: C** — Half of 6 is 3, so add $3^2 = 9$ to BOTH sides: $7 + 9 = 16$.
> - **A** — used 6 inside the bracket instead of half of 6
> - **B** — wrote the 9 on the right instead of $7 + 9$
> - **D** — added the 9 to the left-hand side only

1.7 Hence the solutions of $x^2 + 6x = 7$ are ... (1)

A) **$x = 1$ or $x = -7$** ✓

B) $x = 1$ only

C) $x = 7$ or $x = -1$

D) $x = 4$ or $x = -4$

> **Answer: A** — $x + 3 = \pm 4$, so $x = 1$ or $x = -7$.
> - **B** — a square root has TWO values
> - **C** — made a sign slip on both roots
> - **D** — forgot to subtract the 3 from both answers

1.8 A quadratic equation has ... (1)

A) at least two real roots
B) exactly one real root
C) exactly two real roots
D) at most two real roots ✓

Answer: D — A negative discriminant gives no real roots, and a zero discriminant gives exactly one.

- **A** — there may be none, so 'at least' is wrong
- **B** — that happens only when the discriminant is zero
- **C** — a negative discriminant gives no real roots at all

1.9 Solve for x: $2x^2 - 8 = 0$ (1)

A) $x = 4$ or $x = -4$
B) $x = 2$ **or** $x = -2$ ✓
C) $x = \sqrt{8}$
D) $x = 2$ only

Answer: B — $2x^2 = 8$ gives $x^2 = 4$, so $x = \pm 2$.

- **A** — forgot to divide by the 2 before square-rooting
- **C** — square-rooted the 8 without dividing by the 2 first
- **D** — a square root has TWO values

1.10 Two consecutive POSITIVE integers have a product of 42. The smaller one is ... (1)

A) 6 ✓
B) 7
C) 21
D) 42

Answer: A — $x(x+1) = 42$ gives $x^2 + x - 42 = (x+7)(x-6) = 0$, and the positive root is 6.

- **B** — that is the LARGER of the two integers
- **C** — halved 42 instead of solving the equation
- **D** — read the product as though it were one of the integers

ANSWER GRID — MARKING GUIDELINE

1.1	A	B	C	(D)
1.2	A	B	(C)	D
1.3	A	B	(C)	D
1.4	A	B	C	(D)
1.5	A	(B)	C	D
1.6	A	B	(C)	D
1.7	(A)	B	C	D
1.8	A	B	C	(D)
1.9	A	(B)	C	D
1.10	(A)	B	C	D

QUESTION 2 [12 MARKS]

Solve for x. Where a calculator is needed, give your answers correct to TWO decimal places.

2.1 $2x^2 - 5x + 3 = 0$ (3)

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

$x = \frac{3}{2}$ **or** $x = 1$ *(1)*

2.2 $x = \sqrt{x + 12}$ **(5)**

Square both sides: $x^2 = x + 12$ *(1)*
$x^2 - x - 12 = 0$ *(1)*
$(x - 4)(x + 3) = 0$ *(1)*
Check both in the ORIGINAL equation *(1)*
$x = -3$ gives $\sqrt{9} = 3 \neq -3$, so it is rejected: $\boldsymbol{x = 4}$ *(1)*

2.3 $3x^2 + 5x - 1 = 0$, correct to TWO decimal places **(4)**

$x = \dfrac{-5 \pm \sqrt{25 + 12}}{6}$ *(2)*
$= \dfrac{-5 \pm \sqrt{37}}{6}$ *(1)*
$\boldsymbol{x = 0{,}18}$ **or** $\boldsymbol{x = -1{,}85}$ *(1)*

QUESTION 3 [13 MARKS]

Answer the questions below.

3.1 Solve for x and y simultaneously: $5x - y = 2$ and $2x^2 - 3y = 4$ **(6)**

From the linear equation: $y = 5x - 2$ *(1)*
$2x^2 - 3(5x - 2) = 4$ *(1)*
$2x^2 - 15x + 2 = 0$ *(1)*
$x = \dfrac{15 \pm \sqrt{209}}{4}$ *(1)*
$x = 7{,}36$ gives $y = 34{,}82$ *(1)*
$x = 0{,}14$ gives $y = -1{,}32$ *(1)*

3.2 Determine the value(s) of k for which $x^2 + (k + 2)x + 9 = 0$ has EQUAL roots. **(4)**

Equal roots means $\Delta = 0$ *(1)*
$(k + 2)^2 - 36 = 0$ *(2)*
$\boldsymbol{k = 4}$ **or** $\boldsymbol{k = -8}$ *(1)*

3.3 Explain why the roots of a quadratic can be checked by substituting them back into the ORIGINAL equation, and why this matters when a surd equation is solved. **(3)**

Squaring both sides can introduce a root that does not satisfy the original *(2)*; only substitution into the original shows which one is valid *(1)*

TOTAL: 35 marks

This question paper consists of 3 questions.

© Danemathics — free to print and share for classroom use.