GCSE (1 – 9)
Quadratic Formula

Instructions

• Use black ink or ball-point pen.
• Answer all questions.
• Answer the questions in the spaces provided
  – there may be more space than you need.
• Diagrams are NOT accurately drawn, unless otherwise indicated.
• You must show all your working out.

Information

• The marks for each question are shown in brackets
  – use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.
• Keep an eye on the time.
• Try to answer every question.
• Check your answers if you have time at the end

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1 Solve \( x^2 + 5x + 3 = 0 \)

Give your solutions correct to 2 decimal places.

\[
\begin{align*}
 a &= 1 \quad b = 5 \quad c = 3 \\
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 &= \frac{-(5) \pm \sqrt{(5)^2 - 4(1)(3)}}{2(1)} \\
 &= -0.70 \ (2dp) \quad -4.30 \ (2dp) \\
\end{align*}
\]

(Total for question 1 is 3 marks)

2 Solve \( 2x^2 + 13x + 7 = 0 \)

Give your solutions correct to 2 decimal places.

\[
\begin{align*}
 a &= 2 \quad b = 13 \quad c = 7 \\
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 &= \frac{-(13) \pm \sqrt{(13)^2 - 4(2)(7)}}{2(2)} \\
 &= -0.59 \quad \text{or} \quad -5.91 \ (2dp) \\
\end{align*}
\]

(Total for question 2 is 3 marks)

3 Solve \( 3x^2 + 2x - 13 = 0 \)

Give your solutions correct to 1 decimal place.

\[
\begin{align*}
 a &= 3 \quad b = 2 \quad c = -13 \\
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 &= \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-13)}}{2(3)} \\
 &= 1.8 \ (1dp) \quad \text{and} \quad -2.4 \ (1dp) \\
\end{align*}
\]

(Total for question 3 is 3 marks)
4 Solve \(5x^2 + x - 11 = 0\)

Give your solutions correct to 3 significant figures.

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

\[
a = 5 \quad b = 1 \quad c = -11
\]

\[
x = \frac{-1 \pm \sqrt{1^2 - 4(5)(-11)}}{2(5)}
\]

\[
= 1.39 \text{ (3sf)} \text{ and } -1.59 \text{ (3sf)}
\]

(1.39 and -1.59)

(Total for question 4 is 3 marks)

5 Solve \(3x^2 - 11x - 13 = 0\)

Give your solutions correct to 3 significant figures.

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

\[
a = 3 \quad b = -11 \quad c = -13
\]

\[
x = \frac{-(-11) \pm \sqrt{(-11)^2 - 4(3)(-13)}}{2(3)}
\]

\[
= 4.61 \text{ (3sf)} \text{ and } -0.941 \text{ (3sf)}
\]

(4.61 and -0.941)

(Total for question 5 is 3 marks)

6 Solve \(5x^2 = 6x + 3\)

Give your solutions correct to 3 significant figures.

\[
5x^2 - 6x - 3 = 0
\]

\[
a = 5 \quad b = -6 \quad c = -3
\]

\[
x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(5)(-3)}}{2(5)}
\]

\[
= 1.58 \text{ (3sf)} \text{ and } -0.380 \text{ (3sf)}
\]

(1.58 and -0.380)

(Total for question 6 is 3 marks)
7 Solve $x^2 + 2x - 7 = 0$

Give your answers in the form $a \pm b\sqrt{c}$.

$a = 1$  $b = 2$  $c = -7$

$x = \frac{-2 \pm \sqrt{(-2)^2 - 4(1)(-7)}}{2(1)}$

$= -1 \pm 2\sqrt{2}$

(Total for question 7 is 4 marks)

8 Solve $x^2 - 4x - 1 = 0$

Give your answers in the form $a \pm \sqrt{b}$.

$a = 1$  $b = -4$  $c = -1$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-1)}}{2(1)}$

$= 2 \pm \sqrt{5}$

(Total for question 8 is 4 marks)

9 Solve $x^2 + 6x - 11 = 0$

Give your answers in the form $a \pm b\sqrt{c}$.

$a = 1$  $b = 6$  $c = -11$

$x = \frac{-6 \pm \sqrt{(6)^2 - 4(1)(-11)}}{2(1)}$

$= -3 \pm 2\sqrt{5}$

(Total for question 9 is 4 marks)
The diagram shows a six sided shape formed from two rectangles. All measurements are given in centimetres.

\[
\begin{align*}
&x - 3 \\
&2x + 1 \\
&3x - 9 \\
&4
\end{align*}
\]

The area of the shape is 24cm²

(a) Show that \(2x^2 + 7x - 63 = 0\)

\[
\begin{align*}
(2x + 1)(x - 3) + 4(3x - 9) &= 24 \\
2x^2 - 6x + x - 3 + 12x - 36 &= 24 \\
2x^2 + 7x - 39 &= 24 \\
2x^2 + 7x - 63 &= 0
\end{align*}
\]

(b) Find the value of \(x\)

Give your answer to 3 significant figures

\[
a = 2 \quad b = 7 \quad c = -63
\]

\[
x = \frac{-b\pm\sqrt{b^2-4ac}}{2a} = \frac{-7\pm\sqrt{(7)^2-4(2)(-63)}}{2(2)}
\]

\[
x = 4.13 \text{ or } -7.63 \quad (3sf)
\]

\(x\) cannot be negative or the lengths would be negative \(\therefore x = 4.13\) \(\quad 4.13\) \(\text{(3sf)}\)

(Total for question 10 is 5 marks)
The diagram shows a six sided shape formed from two rectangles. All measurements are given in centimetres.

The area of the shape is $35\text{cm}^2$

(a) Show that $2x^2 + 8x - 25 = 0$

\[
\begin{align*}
2x^2 - x + 10x + 10 &= 35 \\
2x^2 + 9x + 10 &= 35 \\
2x^2 + 9x - 25 &= 0
\end{align*}
\]

(b) Find the value of $x$

Give your answer to 3 significant figures

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

\[
\begin{align*}
a &= 2 \\
b &= 9 \\
c &= -25
\end{align*}
\]

\[
x = \frac{-9 \pm \sqrt{9^2 - 4(2)(-25)}}{2(2)}
\]

\[
x = 1.94 \text{ or } -6.44
\]

$x$ cannot be negative \(\therefore x = 1.94\) (3s.f.)

\[
1.94
\]

(Total for question 11 is 5 marks)
The diagram shows a six sided shape formed from two rectangles. All measurements are given in centimetres.

The area of the shape is 26cm²

(a) Show that \(3x^2 - 21x + 16 = 0\)

\[
3x(x - 5) + 6(7 - x) = 26
\]
\[
3x^2 - 15x + 42 - 6x = 26
\]
\[
3x^2 - 21x + 42 = 26
\]
\[
3x^2 - 21x + 16 = 0
\]

(b) Find the value of \(x\)
Give your answer to 3 significant figures

\[
a = 3 \quad b = -21 \quad c = 16
\]

\[
x = \frac{-(-21) \pm \sqrt{(-21)^2 - 4(3)(16)}}{2(3)}
\]
\[
= 6.13 \text{ or } 0.870 \quad (3s)
\]

\(x\) cannot be 0.870 \(\rightarrow\) This would make \((x - 5)\) negative \(\therefore x = 6.13\)

6.13

(Total for question 12 is 5 marks)
13 The diagram shows a right angled triangle. All measurements are given in centimetres.

\[ x + 1 \quad x + 5 \]
\[ x + 2 \quad 7 \]

(a) Show that \( x^2 - 4x - 20 = 0 \)

\[
(x + 1)^2 + (x + 2)^2 = (x + 5)^2
\]

\[
(x + 1)(x + 1) + (x + 2)(x + 2) = (x + 5)(x + 5)
\]

\[
x^2 + x + x + 1 + x^2 + 2x + 2x + 4 = x^2 + 5x + 5x + 25
\]

\[
2x^2 + 6x + 5 = x^2 + 10x + 25
\]

\[
x^2 - 4x - 20 = 0
\]

(b) Find the value of \( x \)

Give your answer in the form \( a + b\sqrt{c} \).

\[
a = 1 \quad b = -4 \quad c = -20
\]

\[
x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-20)}}{2(1)}
\]

\[
= 2 + 2\sqrt{6}
\]

\[
\frac{2 + 2\sqrt{6}}{\text{(Total for question 13 is 6 marks)}}
\]