The Quadratic Formula
Exam Style Questions

1. Solve $x^2 + 7x + 4 = 0$
   Give your answers to 3 significant figures.

$a = 1$, $b = 7$, $c = 4$

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

$= \dfrac{-7 \pm \sqrt{49 - 16}}{2}$

$= \dfrac{-7 \pm \sqrt{33}}{2}$ $\Rightarrow$ $x = \dfrac{-7 + \sqrt{33}}{2} = -0.628$

$x = \dfrac{-7 - \sqrt{33}}{2} = -6.37$

$x = -0.628$ or
.... $x = -6.37$ .... (3 marks)

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2. Solve $2x^2 + 5x + 1 = 0$
   Give your answers to 3 significant figures.

$a = 2$, $b = 5$, $c = 1$

$x = \dfrac{-5 \pm \sqrt{5^2 - 4(2)(1)}}{2(2)}$

$= \dfrac{-5 \pm \sqrt{25 - 8}}{4}$

$= \dfrac{-5 \pm \sqrt{17}}{4}$ $\Rightarrow$ $x = \dfrac{-5 + \sqrt{17}}{4} = -0.219$

$x = \dfrac{-5 - \sqrt{17}}{4} = -2.28$

$x = -0.219$ or
.... $x = -2.28$ .... (3 marks)

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3. Solve $3x^2 + 7x + 1 = 0$

Give your answers to 3 significant figures.

$a = 3$, $b = 7$, $c = 1$

$$x = \frac{-7 \pm \sqrt{7^2 - 4(3)(1)}}{2(3)}$$

$$= \frac{-7 \pm \sqrt{49 - 12}}{6} = \frac{-7 \pm \sqrt{37}}{6} \Rightarrow$$

$$x = \frac{-7 + \sqrt{37}}{6} = -0.153$$

$$x = \frac{-7 - \sqrt{37}}{6} = -2.18$$

$x = -0.153$ or $x = -2.18$ (3 marks)

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

Give your answers to 3 significant figures.

$a = 1$, $b = -8$, $c = 2$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(2)}}{2(1)}$$

$$= \frac{8 \pm \sqrt{64 - 8}}{2} = \frac{8 \pm \sqrt{56}}{2} \Rightarrow$$

$$x = \frac{8 + \sqrt{56}}{2} = 7.74$$

$$x = \frac{8 - \sqrt{56}}{2} = 0.258$$

$x = 7.74$ or $x = 0.258$ (3 marks)

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5. Solve $3x^2 - 5x + 1 = 0$

Give your answers to 3 significant figures.

$a = 3$, $b = -5$, $c = 1$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(1)}}{2(3)}$$

$$= \frac{5 \pm \sqrt{25 - 12}}{6} = \frac{5 \pm \sqrt{13}}{6} \Rightarrow$$

$$x = \frac{5 + \sqrt{13}}{6} = 1.43$$

$$x = \frac{5 - \sqrt{13}}{6} = 0.232$$

$x = 1.43$, $x = 0.232$ (3 marks)

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6. Solve $x^2 - 7x - 2 = 0$
   Leave your answers in surd form.

   $a = 1, \quad b = -7, \quad c = -2$

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

   $= \dfrac{7 \pm \sqrt{49 + 8}}{2}$

   $= \dfrac{7 \pm \sqrt{57}}{2}$

   $x = \dfrac{7 + \sqrt{57}}{2}$

   $x = \dfrac{7 - \sqrt{57}}{2}$

   .... (3 marks)

7. Solve $-x^2 - x + 1 = 0$
   Leave your answers in surd form.

   $a = -1, \quad b = -1, \quad c = 1$

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

   $= \dfrac{1 \pm \sqrt{1 + 4}}{-2} = \dfrac{1 \pm \sqrt{5}}{-2}$

   $x = \dfrac{-1 - \sqrt{5}}{2}$

   $x = \dfrac{-1 + \sqrt{5}}{2}$

   .... (3 marks)

8. Solve $7x + x^2 - 1 = 0$
   Leave your answers in surd form.

   $x^2 + 7x - 1 = 0$

   $a = 1, \quad b = 7, \quad c = -1$

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

   $= \dfrac{-7 \pm \sqrt{49 + 4}}{2} = \dfrac{-7 \pm \sqrt{53}}{2}$

   $x = \dfrac{-7 + \sqrt{53}}{2}$

   $x = \dfrac{-7 - \sqrt{53}}{2}$

   .... (3 marks)

9. Solve $2x^2 - 3x = 1$

   Give your answers to 3 significant figures.

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

   $a = 2, \ b = -3, \ c = -1$

   $x = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-1)}}{2(2)}$

   $= \dfrac{3 \pm \sqrt{9 + 8}}{4} \qquad = \dfrac{3 \pm \sqrt{17}}{4}$

   $x = \dfrac{3 + \sqrt{17}}{4}$

   $x = \dfrac{3 - \sqrt{17}}{4}$

   .... (3 marks)

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10. Solve $x^2 = 8x - 4$

   Give your answers to 3 significant figures.

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

   $a = 1, \ b = -8, \ c = 4$
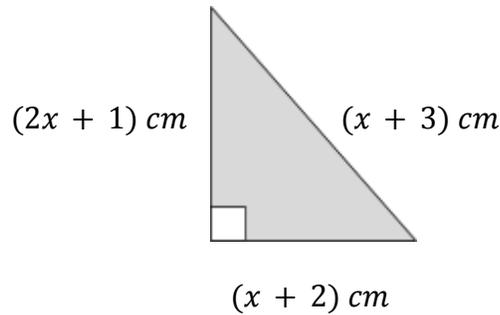
   $x = \dfrac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(4)}}{2(1)}$

   $= \dfrac{8 \pm \sqrt{64 - 16}}{2} \qquad = \dfrac{8 \pm \sqrt{48}}{2} \qquad \Rightarrow \qquad x = \dfrac{8 + \sqrt{48}}{2} = 7.46$

   $x = \dfrac{8 - \sqrt{48}}{2} = 0.536$

   $x = 7.46, \quad x = 0.536$

   .... (3 marks)

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11. Below is a right-angled triangle with lengths $(2x + 1)cm$, $(x + 2)cm$ and $(x + 3)cm$.

$(2x + 1)$ cm $(x + 3)$ cm

$(x + 2)$ cm

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

Using pythagoras,

$$(2x+1)^2 + (x+2)^2 = (x+3)^2$$

$\Rightarrow$ $4x^2 + 4x + 1 + x^2 + 4x + 4 = x^2 + 6x + 9$

$\Rightarrow$ $\qquad 5x^2 + 8x + 5 = x^2 + 6x + 9$

$\Rightarrow$ $\qquad\qquad 4x^2 + 2x - 4 = 0$

$\Rightarrow$ $\qquad\qquad 2x^2 + x - 2 = 0$

(2)

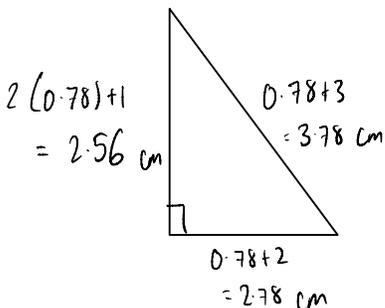(b) Find the area of the triangle, giving your answer to 3 significant figures.

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

$a = 2, \; b = 1, \; c = -2$

$$x = \frac{-1 \pm \sqrt{(1)^2 - 4(2)(-2)}}{2(2)} = \frac{-1 \pm \sqrt{1 + 16}}{4}$$

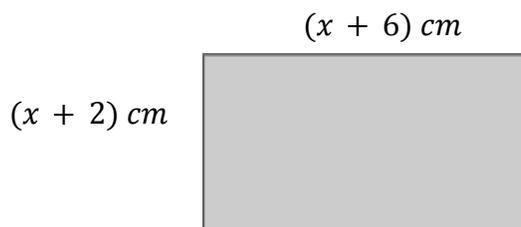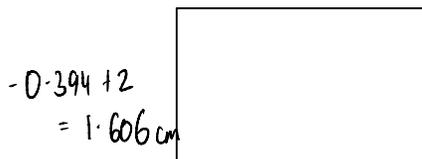$$= \frac{-1 \pm \sqrt{17}}{4} \Rightarrow x = \frac{-1 + \sqrt{17}}{4} = 0.78$$

$$x = \frac{-1 - \sqrt{17}}{4} = -1.28 \quad (\text{not possible})$$

$2(0.78) + 1$
$= 2.56$ cm

$0.78 + 3$
$= 3.78$ cm

$0.78 + 2$
$= 2.78$ cm

Area $= \frac{1}{2} \times 2.56 \times 2.78$

$= 3.5584$

$\underline{\underline{3.56}}$ cm^2 (3)

12. The area of the below rectangle is 9 cm^2.

$(x + 6)\ cm$

$(x + 2)\ cm$ [rectangle]

(a) Show that $x^2 + 8x + 3 = 0$

$A = bh \Rightarrow (x+6)(x+2) = 9$

$\Rightarrow x^2 + 8x + 12 = 9$

$\Rightarrow x^2 + 8x + 3 = 0$

(2)

(b) Hence, find the perimeter of the rectangle, giving your answer to 1 decimal place.

$-0.394 + 6 = 5.606\ cm$

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

$a = 1, b = 8, c = 3$

$x = \dfrac{-8 \pm \sqrt{(8)^2 - 4(1)(3)}}{2(1)}$

$= \dfrac{-8 \pm \sqrt{64 - 12}}{2}$

$= \dfrac{-8 \pm \sqrt{52}}{2} \Rightarrow$

$-0.394 + 2$
$= 1.606\ cm$ [rectangle]

$x = \dfrac{-8 + \sqrt{52}}{2} = -0.394$

$x = \dfrac{-8 - \sqrt{52}}{2} = -7.606$ (Not possible)

$P = 2(5.606)$
$+ 2(1.606)$
$= 14.424$

$14.4\ cm$ (3)