WS # 1
Quadratic functions Solutions

Name: _____

1 Factorise and solve for x:
$x^2 + 2x - 6 = 0$

$$x^2 + 2x - 6 = 0$$
$$x^2 + 2x + 1 - 1 - 6 = 0$$
$$(x+1)^2 - 7 = 0$$
$$(x+1-\sqrt{7})(x+1+\sqrt{7}) = 0$$
$$x = -1+\sqrt{7} \text{ or } x = -1-\sqrt{7}$$

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2 Factorise and solve for x:
$3x - x^2 = 1$

$$3x - x^2 = 1$$
$$0 = x^2 - 3x + 1$$
$$x^2 - 3x + \frac{9}{4} - \frac{9}{4} + 1 = 0$$
$$\left(x - \frac{3}{2}\right)^2 - \frac{5}{4} = 0$$
$$\left(x - \frac{3}{2} - \frac{\sqrt{5}}{2}\right)\left(x - \frac{3}{2} + \frac{\sqrt{5}}{2}\right) = 0$$
$$x = \frac{3}{2} + \frac{\sqrt{5}}{2} \text{ or } x = \frac{3}{2} - \frac{\sqrt{5}}{2}$$

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3 Use the quadratic formula to find exact values for x in the equation $3x^2 - x - 1 = 0$.

$$3x^2 - x - 1 = 0$$
$$a = 3,\ b = -1,\ c = -1$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{1 \pm \sqrt{1+12}}{6}$$
$$x = \frac{1+\sqrt{13}}{6} \text{ or } x = \frac{1-\sqrt{13}}{6}$$

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4 Use the quadratic formula to find exact values for x given $3-2x^2=7x$.

$3-2x^2=7x$

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

$a=-2,\ b=-7,\ c=3$

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

$$=\frac{7\pm\sqrt{49+24}}{-4}$$

$$x=\frac{7+\sqrt{73}}{-4}\quad\text{or}\quad x=\frac{7-\sqrt{73}}{-4}$$

$$x=\frac{-7-\sqrt{73}}{4}\quad\text{or}\quad x=\frac{-7+\sqrt{73}}{4}$$

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5 Find the value for the discriminant in $-5x^2+x-3=0$.

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

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

$\Delta=b^2-4ac$

$=1-4\times-5\times-3$

$=1-60$

$=-59$

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6 Use the value for the discriminant to determine the number and type of solutions for $7x^2-3x-5=0$.

$7x^2-3x-5=0$

$a=7,\ b=-3,\ c=-5$

$\Delta=b^2-4ac$

$=9-4\times7\times-5$

$=9+140$

$=149$

Since $\Delta>0$, the equation has two real solutions.

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7 For what values of k does the following equation have just one solution?
$(4k+1)x^2+3kx+1=0$

$(4k+1)x^2+3kx+1=0$

$a=4k+1,\ b=3k,\ c=1$

$\Delta=b^2-4ac$

$=9k^2-4\times(4k+1)\times1$

$=9k^2-16k-4$

For one solution, require $\Delta=0$.

$0=(9k+2)(k-2)$

$k=-\frac{2}{9}$ or $k=2$ for one solution

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8 Sketch the parabola with equation $y = -2(x-3)^2 + 4$, showing clearly the turning point and *y*-intercept.

$y = -2(x-3)^2 + 4$

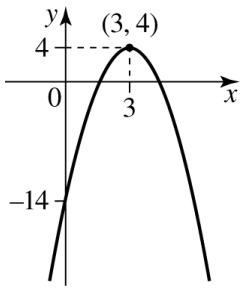
A negative coefficient of x^2 means a maximum turning point.

The coordinates of the turning point are (3, 4).

y-intercept: when $x = 0$,

$y = -2(-3)^2 + 4$

$y = -14$



9 Convert the following quadratic into turning point form to determine the coordinates of the turning point:

$y = x^2 + 6x - 11$

Sketch the parabola, showing all intercepts and the turning point.

$y = x^2 + 6x - 11$

$y = x^2 + 6x + 9 - 9 - 11$

$y = (x+3)^2 - 20$

The turning point is (–3,–20).

A positive coefficient of x^2 means a minimum turning point.

y-intercept: when $x = 0$, $y = -11$

x-intercept: when $y = 0$, $0 = x^2 + 6x - 11$

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

$$x = \frac{-6 \pm \sqrt{36+44}}{2}$$

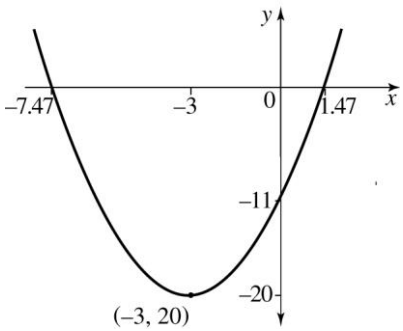
$$= \frac{-6 \pm \sqrt{80}}{2}$$

$$= \frac{-6 \pm 4\sqrt{5}}{2}$$

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

$x = -3 + 2\sqrt{5}$ or $x = -3 - 2\sqrt{5}$

$x \approx 1.47$ or $x \approx -7.47$



10 The graphs with equations $y = x^2 + 5x - 9$ and $y = cx - 10$ intersect once only. Find the possible values of c.

$y = x^2 + 5x - 9$ [1]

$y = cx - 10$ [2]

$$x^2 + 5x - 9 = cx - 10$$

$$x^2 + 5x - cx + 1 = 0$$

$$x^2 + (5 - c)x + 1 = 0$$

$$\Delta = (5 - c)^2 - 4 \times 1$$

$$= 25 - 10c + c^2 - 4$$

$$= c^2 - 10c + 21$$

$\Delta = 0$, for one solution only.

$c^2 - 10c + 21 = 0$

$(c - 7)(c - 3) = 0$

$c = 7$ or $c = 3$