Question 5 **5.1** The turning point of f is $(-2, -5)$.

5.2 To find the x-coordinates of A and B, we need to solve the system of equations:

$$f(x) = g(x)$$

$$-(x3)^2 4 = x5$$

Expanding and simplifying, we get:

$$-x^2 - 6x - 5 = x5$$

$$-x^2 - 7x - 10 = 0$$

Using the quadratic formula, we find that:

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(-1)(-10)}}{2(-1)}$$

$$x = \frac{7 \pm \sqrt{4940}}{-2}$$

$$x = \frac{7 \pm \sqrt{89}}{-2}$$

Therefore, the x-coordinates of A and B are:

$$x = \frac{7\sqrt{89}}{-2} \approx -2$$

and

$$x = \frac{7 - \sqrt{89}}{-2} \approx -5$$

5.3 Hence, the x-coordinates of A and B are -5 and -2, respectively.

5.4 To determine the values of c for which the equation $(x - c3)^2 4 = xc5$ has one negative and one positive root, we need to find the discriminant of the quadratic equation:

$$b^2 - 4ac$$

Substituting $a = 1$, $b = -c7$, and $c = c5$, we get:

$$(-c7)^2 - 4(1)(c5)$$

$$c^2 - 14c49 - 4c - 20$$

$$c^2 - 18c29$$

For the equation to have one negative and one positive root, the discriminant must be positive:

$$c^2 - 18c29 > 0$$

We can solve this inequality using the quadratic formula:

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

Substituting $a = 1$, $b = -18$, and $c = 29$, we get:

$$c = \frac{-(-18) \pm \sqrt{(-18)^2 - 4(1)(29)}}{2(1)}$$

$$c = \frac{18 \pm \sqrt{324 - 116}}{2}$$

$$c = \frac{18 \pm \sqrt{208}}{2}$$

$$c = \frac{18 \pm 2\sqrt{52}}{2}$$

$$c = 9 \pm \sqrt{52}$$

Therefore, the values of c for which the equation $(x - c3)^2 4 = xc5$ has one negative and one positive root are $c = 9\sqrt{52}$ and $c = 9 - \sqrt{52}$.

5.5 To find the maximum distance between f and g in the interval $x_1 \leq x \leq x_2$, we need to find the maximum value of the function $|f(x) - g(x)|$ in that interval.

$$|f(x) - g(x)| = | - (x3)^2 4 - (x5)|$$
$$= |x^2 6x94 - x - 5|$$
$$= |x^2 5x8|$$

Since the function $|x^2 5x8|$ is a parabola that opens upwards, its minimum value occurs at its vertex. The vertex of the parabola is at $x = -\frac{b}{2a} = -\frac{5}{2(1)} = -\frac{5}{2}$. The minimum value of the function is therefore:

$$|f(-\frac{5}{2}) - g(-\frac{5}{2})| = |(-\frac{5}{2})^2 5(-\frac{5}{2})8 - (-\frac{5}{2}5)|$$

$$= |\frac{25}{4} - \frac{25}{2}8 - \frac{3}{2}|$$

$$= |\frac{25}{4} - \frac{50}{4}\frac{32}{4} - \frac{6}{4}|$$

$$= |\frac{5}{4}|$$
$$= \frac{5}{4}$$

Therefore, the maximum distance between f and g in the interval $x_1 \leq x \leq x_2$ is $\frac{5}{4}$.

5.6 If $h(x) = f(x)k$, then the graph of $h(x)$ is the graph of $f(x)$ shifted up by k units. Therefore, the graph of $h(x)$ will pass through the point $(-2, -5k)$. Since the graph of $h(x)$ also passes through the point $(0, 0)$, we have:

$$h(0) = 0$$
$$f(0)k = 0$$
$$-5k = 0$$
$$k = 5$$

Therefore, the equation of $h(x)$ is:

$$h(x) = f(x)5 = -(x3)^2 45$$
$$h(x) = -x^2 - 6x - 19$$
$$h(x) = -x^2 - 6x8$$