1. a) $x^2 - 2x = 35$

$\therefore x^2 - 2x - 35 = 0$ **M1**

$\therefore (x-7)(x+5) = 0$ **M1**

$\therefore x = 7$ or $x = -5$ **A1**

b) $(x+2)^2 = -x$

$\therefore (x+2)(x+2) = -x$

$\therefore x^2 + 4x + 4 = -x$

$\therefore x^2 + 5x + 4 = 0$ **M1**

$\therefore (x+4)(x+1) = 0$ **M1**

$\therefore x = -4$ or $x = -1$ **A1**

c) $x(x+1) = 6$

$\therefore x^2 + x = 6$

$\therefore x^2 + x - 6 = 0$ **M1**

$\therefore (x+3)(x-2) = 0$ **M1**

$\therefore x = -3$ or $x = 2$ **A1**

d) $(x+3)(x+4) = x+4$

$\therefore x^2 + 3x + 4x + 12 = x + 4$

$\therefore x^2 + 7x + 12 = x + 4$

$\therefore x^2 + 6x + 8 = 0$ **M1**

$\therefore (x+4)(x+2) = 0$ **M1**

$\therefore x = -4$ or $x = -2$ **A1** **[12 Marks]**

2. a) $a = 2$, $b = -3$, $c = -1$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-1)}}{2(2)} = \frac{3 \pm \sqrt{17}}{4}$$ **M1**

> **Technique:** Use the quadratic formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\therefore x = \frac{3+\sqrt{17}}{4} \text{ or } x = \frac{3-\sqrt{17}}{4}$$ **A1**

b) $5x^2 = 2x + 3 \therefore 5x^2 - 2x - 3 = 0$

> **Technique:** Rearrange the equation into the form $ax^2 + bx + c = 0$ first

$a = 5$, $b = -2$, $c = -3$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(5)(-3)}}{2(5)} = \frac{2 \pm \sqrt{4+60}}{10} = \frac{2 \pm \sqrt{64}}{10} = \frac{2 \pm 8}{10}$$ **M1**

$$\therefore x = -\frac{3}{5} \text{ or } x = 1$$ **A1**

c) $(2x+3)^2 = (2x+3)(2x+3) = 8$

> **Technique:** Rearrange the equation into the form $ax^2 + bx + c = 0$ first

$\therefore 4x^2 + 6x + 6x + 9 = 8$

$\therefore 4x^2 + 12x + 1 = 0$ **M1**

$a = 4$, $b = 12$, $c = 1$

$$x = \frac{-12 \pm \sqrt{12^2 - 4(4)(1)}}{2(4)} = \frac{-12 \pm \sqrt{144-16}}{8}$$

$$= \frac{-12 \pm \sqrt{128}}{8} = \frac{-12 \pm 8\sqrt{2}}{8} = \frac{-3 \pm 2\sqrt{2}}{2}$$ **M1**

$$\therefore x = \frac{-3+2\sqrt{2}}{2} \text{ or } x = \frac{-3-2\sqrt{2}}{2}$$ **A1** **[7 Marks]**

3. a) $x^2 - 4x + 4 = \left(x - \frac{4}{2}\right)^2 - \left(\frac{4}{2}\right)^2 + 4$

> **Technique:** Halve the coefficient of x and then take away its square, i.e.
> $x^2 + ax = \left(x + \frac{a}{2}\right)^2 - \left(\frac{a}{2}\right)^2$

$= (x-2)^2 - 2^2 + 4 = (x-2)^2 = 0$ **M1**

$\therefore x = 2$ (one repeated root) **A1**

b) $x^2 + 6x + 3 = (x+3)^2 - 3^2 + 3 = 0$

$\therefore (x+3)^2 - 6 = 0$ **M1**

$\therefore (x+3)^2 = 6$

$\therefore x + 3 = \pm\sqrt{6}$

$\therefore x = -3 + \sqrt{6}$ or $x = -3 - \sqrt{6}$ **A1**

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

$\left(x + \frac{5}{2}\right)^2 - \left(\frac{5}{2}\right)^2 - 1 = 0$

$\left(x + \frac{5}{2}\right)^2 - \frac{25}{4} - 1 = 0$

$\left(x + \frac{5}{2}\right)^2 - \frac{29}{4} = 0$

$\left(x + \frac{5}{2}\right)^2 = \frac{29}{4}$ **M1**

$\therefore x + \frac{5}{2} = \pm\sqrt{\frac{29}{4}} = \pm\frac{\sqrt{29}}{2}$

$\therefore x = -\frac{5}{2} \pm \frac{\sqrt{29}}{2}$

$\therefore x = -\frac{5}{2} + \frac{\sqrt{29}}{2}$ or $x = -\frac{5}{2} - \frac{\sqrt{29}}{2}$ **A1** **[6 Marks]**

4. $x^2 + 2x - 5 = \left(x + \frac{2}{2}\right)^2 - \left(\frac{2}{2}\right)^2 - 5$ **M1**

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

$= (x+1)^2 - 6$ (where $p = 1$, $q = 1$ and $r = -6$) **A1** **[2 Marks]**

5. $2x^2 - 4x + 8 = 2(x^2 - 2x) + 8$

$= 2\left((x-1)^2 - 1^2\right) + 8$ **M1**

$= 2(x-1)^2 - 2 + 8$

$= 2(x-1)^2 + 6$ (where $p = 2$, $q = -1$ and $r = 6$) **A1** **[2 Marks]**

6. a) $f(x) = 3x - 15 \therefore f(2) = 3(2) - 15 = 6 - 15 = -9$ **A1**

$g(x) = x^2 + 11x + 1 \therefore g(5) = 5^2 + 11(5) + 1 = 25 + 55 + 1 = 81$ **A1**

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

$3x - 15 = x^2 + 11x + 1$

$\therefore x^2 + 11x - 3x + 1 + 15 = 0$

$\therefore x^2 + 8x + 16 = 0$ **M1**

$\therefore (x+4)(x+4) = 0$ **M1**

$\therefore x = -4$ (one repeated root) **A1** **[5 Marks]**

7. a) $a=5$, $b=12$, $c=8$

$b^2-4ac=12^2-4(5)(8)$

$=144-160=-16$ **A1**

$-16<0 \therefore$ no real roots **A1**

b) $g(x)=(-x+6)(2x+3)$

$=-2x^2-3x+12x+18$

$=-2x^2+9x+18$ **M1**

$a=-2$, $b=9$, $c=18$

$b^2-4ac=9^2-4(-2)(18)=81+144=225$ **A1**

$225>0 \therefore$ two real roots **A1**

c) $a=3$, $b=-6$, $c=2$

$b^2-4ac=(-6)^2-4(3)(2)=36-21=12$ **A1**

$12>0 \therefore$ two real roots **A1**

d) $j(x)=(2x+8)(3x-4)=6x^2-8x+24x-32$

$=6x^2+16x-32$ **M1**

$a=6$, $b=16$, $c=-32$

$b^2-4ac=16^2-4(6)(-32)=256+768=1024$ **A1**

$1024>0 \therefore$ two real roots **A1** **[10 Marks]**

8. $2x=\sqrt{4x+3}$

$\therefore 4x^2=4x+3$

$\therefore 4x^2-4x-3=0$ **M1**

$a=4$, $b=-4$, $c=-3$

$$x=\frac{-(-4)\pm\sqrt{(-4)^2-4(4)(-3)}}{2(4)}=\frac{4\pm\sqrt{16+48}}{8}=\frac{4\pm\sqrt{64}}{8}=\frac{4\pm 8}{8}$$ **M1**

$\therefore x=\frac{3}{2}$ or $x=-\frac{1}{2}$ (both solutions allowed as $x>-\frac{3}{4}$) **A1** **[3 Marks]**

9. $a=1$, $b=k$, $c=4$

$b^2-4ac=0$ for one repeated root **M1**

So there is one repeated root if $k^2-4(1)(4)=0$ **M1**

$\therefore k^2=16 \ \therefore k=\pm 4$

$\therefore k=4$ or $k=-4$ **A1** **[3 Marks]**

10. $a=2$, $b=-5$, $c=A$

$b^2-4ac=0$ for one solution **M1**

So there is one solution if $(-5)^2-4(2)A=0$ **M1**

$\therefore 25=8A$

$\therefore A=\frac{25}{8}$ **A1** **[3 Marks]**

TOTAL 53 MARKS