

Completing the Square $a \neq 1$

$$\textcircled{1} \quad 10r^2 - 20r - 88 = -8$$

$$\qquad \qquad \qquad +88 \quad +88$$

$$10r^2 - 20r = 80$$

$$10(r^2 - 2r) = 80$$

$$10(r^2 - 2r + 1) = 80 + 10$$

$$10(r-1)^2 = 90$$

$$\sqrt{(r-1)^2} = \sqrt{9}$$

$$r-1 = \pm 3$$

$$+1 \quad +1$$

$$\boxed{r = 4, -2}$$

$$\textcircled{2} \quad 6v^2 - 12v - 147 = -3$$

$$\qquad \qquad \qquad +147 \quad +147$$

$$6v^2 - 12v = 144$$

$$6(v^2 - 2v) = 144$$

$$6(v^2 - 2v + 1) = 144 + 6$$

$$6(v-1)^2 = 150$$

$$\sqrt{(v-1)^2} = \sqrt{25}$$

$$v-1 = \pm 5$$

$$+1 \quad +1$$

$$\boxed{v = 6, -4}$$

$$\textcircled{3} \quad 2x^2 - 3x - 3 = 0$$

$$2x^2 - 3x = 3$$

$$2(x^2 - \frac{3}{2}x) = 3$$

$$2(x^2 - \frac{3}{2}x + \frac{9}{16}) = 3 + \frac{18}{16}$$

$$2(x - \frac{3}{4})^2 = \frac{33}{8}$$

$$\sqrt{(x - \frac{3}{4})^2} = \sqrt{\frac{33}{16}}$$

$$x - \frac{3}{4} = \pm \frac{\sqrt{33}}{4}$$

$$+\frac{3}{4} \quad +\frac{3}{4}$$

$$\boxed{x = \frac{3}{4} \pm \frac{\sqrt{33}}{4}}$$

OR

$$\boxed{x = \frac{3 \pm \sqrt{33}}{4}}$$

$$\textcircled{4} \quad 2x^2 + x - 3 = 0$$

$$2x^2 + x = 3$$

$$2(x^2 + \frac{1}{2}x) = 3$$

$$2(x^2 + \frac{1}{2}x + \frac{1}{16}) = 3 + \frac{1}{8}$$

$$2(x + \frac{1}{4})^2 = \frac{25}{8}$$

$$\sqrt{(x + \frac{1}{4})^2} = \sqrt{\frac{25}{16}}$$

$$x + \frac{1}{4} = \pm \frac{5}{4}$$

$$-\frac{1}{4} \quad -\frac{1}{4}$$

$$\frac{4}{4}, \frac{-6}{4}$$

$$\boxed{x = 1, -\frac{3}{2}}$$

$$2x^2 + 5x + 7 = 0$$

$$2x^2 + 5x = -7$$

$$2\left(x^2 + \frac{5}{2}x\right) = -7$$

$$2\left(x^2 + \frac{5}{2}x + \frac{25}{16}\right) = -7 + \frac{50}{16}$$

$$\frac{2\left(x + \frac{5}{4}\right)^2}{2} = \frac{-31}{8}$$

$$\sqrt{\left(x + \frac{5}{4}\right)^2} = \sqrt{\frac{-31}{8}}$$

$$x + \frac{5}{4} = \pm i \frac{\sqrt{31}}{4}$$

$$x = \frac{-5}{4} \pm i \frac{\sqrt{31}}{4}$$

$$x = \frac{-5 \pm i\sqrt{31}}{4}$$

$$x = \frac{-5 \pm i\sqrt{31}}{4}$$