2. $r^2 - 10r + 25 = 1$

$(r - 5)^2 = 1$

$r - 5 = \pm 1$

$r = 5 \pm 1$

The solutions are $r = 4$ and $r = 6$.

4. $m^2 + 8m + 16 = 45$

$(m + 4)^2 = 45$

$m + 4 = \pm 3\sqrt{5}$

$m = -4 \pm 3\sqrt{5}$

The solutions are $m = -4 - 3\sqrt{5}$ and $m = -4 + 3\sqrt{5}$.

6. $x^2 - 26x + 169 = -13$

$(x - 13)^2 = -13$

$x - 13 = \pm i\sqrt{13}$

$x = 13 \pm i\sqrt{13}$

The solutions are $x = 13 - i\sqrt{13}$ and $x = 13 + i\sqrt{13}$.

8. $4x^2 - 8x + 4 = 1$

$4(x^2 - 2x + 1) = 1$

$4(x - 1)^2 = 1$

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

$x - 1 = \pm\frac{1}{2}$

$x = 1 \pm \frac{1}{2}$

The solutions are $x = \frac{1}{2}$ and $x = \frac{3}{2}$.

10. In this binomial, $b = 20$.

Step 1 Find $\left(\frac{b}{2}\right)^2$. $\left(\frac{20}{2}\right)^2 = 100$

Step 2 Add the result to $x^2 + bx$.

$x^2 + 20x + 100 = (x + 10)^2$

12. In this binomial, $b = -22$.

Step 1 Find $\left(\frac{b}{2}\right)^2$. $\left(\frac{-22}{2}\right)^2 = 121$

Step 2 Add the result to $t^2 + bt$.

$t^2 - 22t + 121 = (t - 11)^2$

14. In this binomial, $b = 24$.

Step 1 Find $\left(\frac{b}{2}\right)^2$. $\left(\frac{24}{2}\right)^2 = 144$

Step 2 Add the result to $x^2 + bx$.

$x^2 + 24x + 144 = (x + 12)^2$

16. In this binomial, $b = 9$.

Step 1 Find $\left(\frac{b}{2}\right)^2$. $\left(\frac{9}{2}\right)^2 = \frac{81}{4}$

Step 2 Add the result to $x^2 + bx$.

$$x^2 + 9x + \frac{81}{4} = \left(x + \frac{9}{2}\right)^2$$

18. In this binomial, $b = -17$.

Step 1 Find $\left(\frac{b}{2}\right)^2$. $\left(\frac{-17}{2}\right)^2 = \frac{289}{4}$

Step 2 Add the result to $s^2 + bs$.

$$s^2 - 17s + \frac{289}{4} = \left(s - \frac{17}{2}\right)^2$$

20. The value of c is $6 \cdot 6 = 36$; $x^2 + 12x + 36 = (x + 6)^2$.

22.
$$s^2 + 2s - 6 = 0$$
$$s^2 + 2s = 6$$
$$s^2 + 2s + 1 = 6 + 1$$
$$(s + 1)^2 = 7$$
$$s + 1 = \pm\sqrt{7}$$
$$s = -1 \pm \sqrt{7}$$

The solutions are $s = -1 - \sqrt{7}$ and $s = -1 + \sqrt{7}$.

24. $t^2 - 8t - 5 = 0$

$$t^2 - 8t = 5$$
$$t^2 - 8t + 16 = 5 + 16$$
$$(t - 4)^2 = 21$$
$$t - 4 = \pm\sqrt{21}$$
$$t = 4 \pm \sqrt{21}$$

The solutions are $x = 4 - \sqrt{21}$ and $x = 4 + \sqrt{21}$.

26. $x(x + 8) = -20$

$$x^2 + 8x = -20$$
$$x^2 + 8x + 16 = -20 + 16$$
$$(x + 4)^2 = -4$$
$$x + 4 = \pm 2i$$
$$x = -4 \pm 2i$$

The solutions are $x = -4 - 2i$ and $x = -4 + 2i$.

28. $6r^2 + 6r + 12 = 0$

$$r^2 + r + 2 = 0$$
$$r^2 + r = -2$$
$$r^2 + r + \frac{1}{4} = -2 + \frac{1}{4}$$
$$\left(r + \frac{1}{2}\right)^2 = -\frac{7}{4}$$
$$r + \frac{1}{2} = \pm i\frac{\sqrt{7}}{2}$$
$$r = \frac{-1 \pm i\sqrt{7}}{2}$$

The solutions are $r = \dfrac{-1 - i\sqrt{7}}{2}$ and $r = \dfrac{-1 + i\sqrt{7}}{2}$.

30.
$$4w(w-3) = 24$$
$$w(w-3) = 6$$
$$w^2 - 3w = 6$$
$$w^2 - 3w + \frac{9}{4} = 6 + \frac{9}{4}$$
$$\left(w - \frac{3}{2}\right)^2 = \frac{33}{4}$$
$$w - \frac{3}{2} = \pm\frac{\sqrt{33}}{2}$$
$$w = \frac{3 \pm \sqrt{33}}{2}$$

The solutions are $w = \frac{3 - \sqrt{33}}{2}$ and $w = \frac{3 - \sqrt{33}}{2}$.

32.
$$3s^2 + 8s = 2s - 9$$
$$3s^2 + 6s = -9$$
$$s^2 + 2s = -3$$
$$s^2 + 2s + 1 = -3 + 1$$
$$(s+1)^2 = -2$$
$$s + 1 = \pm i\sqrt{2}$$
$$s = -1 \pm i\sqrt{2}$$

The solutions are $s = -1 - i\sqrt{2}$ and $s = -1 + i\sqrt{2}$.

34. Use completing the square because the equation cannot be factored or written in the form $u^2 = d$.

$$x^2 - 18x + 64 = 0$$
$$x^2 - 18x = -64$$
$$x^2 - 18x + 81 = -64 + 81$$
$$(x - 9)^2 = 17$$
$$x - 9 = \pm\sqrt{17}$$
$$x = 9 \pm \sqrt{17}$$

The solutions are $x = 9 + \sqrt{17}$ and $x = 9 - \sqrt{17}$.

36. Use square roots because the equation is of the form $u^2 = d$.

$$(x - 7)^2 = -9$$
$$x - 7 = \pm 3i$$
$$x = 7 \pm 3i$$

The solutions are $x = 7 + 3i$ and $x = 7 - 3i$.

38. Use factoring because the left-hand side factors.

$$x^2 + 13x + 22 = 0$$
$$(x + 11)(x + 2) = 0$$
$$x + 11 = 0 \quad \text{or} \quad x + 2 = 0$$
$$x = -11 \quad \text{or} \quad x = -2$$

The solutions are $x = -11$ and $x = -2$.

40. Use completing the square because the equation cannot be factored or written in the form $u^2 = d$.

$$3x^2 + 12x + 13 = 0$$
$$3x^2 + 12x = -13$$
$$3(x^2 + 4x) = -13$$
$$3(x^2 + 4x + 4) = -13 + 12$$
$$3(x + 2)^2 = -1$$
$$(x + 2)^2 = -\frac{1}{3}$$
$$x + 2 = \pm i\sqrt{\frac{1}{3}}$$
$$x + 2 = \pm i\frac{\sqrt{3}}{3}$$
$$x = -2 \pm i\frac{\sqrt{3}}{3}$$

The solutions are $x = -2 + i\frac{\sqrt{3}}{3}$ and $x = -2 - i\frac{\sqrt{3}}{3}$.

42. Use square roots because the equation can be written in the form $u^2 = d$.

$$4x^2 - 20 = 0$$
$$4x^2 = 20$$
$$x^2 = 5$$
$$x = \pm\sqrt{5}$$

The solutions are $x = -\sqrt{5}$ and $x = \sqrt{5}$.

44. $y = x^2 - 4x - 1$

$y + ? = (x^2 - 4x + ?) - 1$

$y + 4 = (x^2 - 4x + 4) - 1$

$y + 4 = (x - 2)^2 - 1$

$y = (x - 2)^2 - 5$

The vertex form of the function is $y = (x - 2)^2 - 5$.
The vertex is $(2, -5)$.

46. $h(x) = x^2 + 20x + 90$

$h(x) + ? = (x^2 + 20x + ?) + 90$

$h(x) + 100 = (x^2 + 20x + 100) + 90$

$h(x) + 100 = (x + 10)^2 + 90$

$h(x) = (x + 10)^2 - 10$

The vertex form of the function is $h(x) = (x + 10)^2 - 10$.
The vertex is $(-10, -10)$.