Day 3: **Solve each equation by completing the square.**

* Not factorable
* b term is even
* Find the vertex (convert)

1) $r^2 - 4r - 21 = 0$ $\boxed{r=7 \mid r=-3}$

*	r	-2
r	r^2	
-2		

$(r-2)(r-2) - 21 = 0 + 4$

$(r-2)^2 - 21 = 4$

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

$r - 2 = \pm 5$

$r = 2 \pm 5$

2) $x^2 - 4x - 60 = 0$ (a b c)

$x^2 - 4x \underline{+4} = 60 \underline{+4}$

$(\frac{b}{2})^2$

$\sqrt{(x-2)^2} = \sqrt{64}$

$x - 2 = \pm 8$

$x = 2 \pm 8$

$\boxed{x = 10 \mid x = -6}$

3) $x^2 + 16x - 57 = 0$

$x = \frac{-b}{2a}$

$(x+8)^2 \underline{-121} = 0$ * vertex form *

y value of vertex

$x = \frac{-16}{2(1)}$

$x = -8$ x value of vertex

$(x+8)^2 = 121$

$x + 8 = \pm 11$

$x = -8 \pm 11$

$\boxed{x = 3 \mid x = -19}$

4) $b^2 + 6b + 8 = 0$

$(b+3)^2 = -8 + 9$

$(b+3)^2 = 1$

$(b+3) = \pm 1$

$b = -3 \pm 1$

$\boxed{b = -4 \mid b = -2}$

5) $a^2 - 16a + 22 = 0$

$(a-8)^2 = -22 + 64$

$(a-8)^2 = 42$

$a - 8 = \pm\sqrt{42}$

$\boxed{a = 8 \pm \sqrt{42}}$

6) $n^2 + 16n - 80 = 0$

$(n+8)^2 = 80 + 64$

$(n+8)^2 = 144$

$n + 8 = \pm 12$

$n = -8 \pm 12$

$\boxed{n = 4 \mid n = -20}$

7) $x^2 + 4x - 32 = 0$

$(x+2)^2 = 32 + 4$

$(x+2)^2 = 36$

$x + 2 = \pm 6$

$x = -2 \pm 6$

$\boxed{x = 4 \mid x = -8}$

8) $r^2 + 2r - 99 = 0$

$(r+1)^2 = 99 + 1$

$(r+1)^2 = 100$

$r + 1 = \pm 10$

$r = -1 \pm 10$

$\boxed{r = 9 \mid r = -11}$

9) $n^2 - 4n - 12 = 0$

$(n-2)^2 = 12 + 4$

$(n-2)^2 = 16$

$n - 2 = \pm 4$

$n = 2 \pm 4$ $\boxed{n = 6 \mid n = -2}$

$x = \frac{-16}{2(8)}$

$= \frac{-16}{16}$

10) $k^2 - 12k + 32 = 0$

$(k-6)^2 = 32 + 36$

$(k-6)^2 = 68$

$k - 6 = \pm 2\sqrt{17}$

$\boxed{k = 6 \pm 2\sqrt{17}}$

11) $8x^2 + 16x - 90 = 0$

$8x^2 + 16x = 90$

$\boxed{x = 2.5 \mid x = -4.5}$

$\frac{8x^2 + 16x}{8} = \frac{90}{8}$

$8(x^2 + 2x \underline{+1}) = 90 \underline{+8}$

$(\frac{b}{2})^2$

$8(x+1)^2 = 98$

$(x+1)^2 = 12.25$

$x + 1 = \pm 3.5$

$x = -1 \pm 3.5$

12) $5b^2 + 10b - 45 = 0$

$5(b^2 + 2b - 9) = 0$

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

$x = -1$

$5(x+1)^2 - 50 = 0$

$5(x+1)^2 = 50$

$(x+1)^2 = 10$

$x + 1 = \pm\sqrt{10}$

$\boxed{x = -1 \pm \sqrt{10}}$

13) $9x^2 - 18x - 55 = 0$

$9x^2 - 18x = 55$

$9(x^2 - 2x) = 55$

$9(x-1)^2 = 55 + 9$

$9(x-1)^2 = 64$

$(x-1)^2 = 7.1$

$\boxed{x = 1 \pm \sqrt{7.1}}$

14) $3x^2 - 18x - 21 = 0$

$3(x^2 - 6x) = 21$

$3(x-3)^2 = 21 + 27$

$3(x-3)^2 = 48$

$(x-3)^2 = 16$

$x - 3 = \pm 4$

$x = 3 \pm 4$

$\boxed{x = 7 \mid x = -1}$

15) $4x^2 - 16x + 15 = 0$

$4(x^2 - 4x) = -15$

$4(x-2)^2 = -15 + 16$

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

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

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

$\boxed{x = 2.5}$

$\boxed{x = 1.5}$

16) $2k^2 - 16k + 30 = 0$

$2(k^2 - 8k) = -30$

$2(k-4)^2 = -30 + 32$

$2(k-4)^2 = 2$

$(k-4)^2 = 1$ $\quad k - 4 = \pm 1$ $\quad k = 4 \pm 1$

$\boxed{k = 5}$

$\boxed{k = 3}$

17) $7x^2 + 14x - 56 = 0$

$7(x^2 + 2x) = 56$

$7(x+1)^2 = 56 + 7$

$7(x+1)^2 = 63$

$(x+1)^2 = 9$

$(x+1) = \pm 3$

$x = -1 \pm 3$

$\boxed{x = -4}$

$\boxed{x = 2}$

18) $3b^2 - 12b - 15 = 0$

$3(b^2 - 4b) = 15$

$3(b-2)^2 = 15 + 12$

$3(b-2)^2 = 27$

$(b-2)^2 = 9$

$b - 2 = \pm 3$

$b = 2 \pm 3$

$\boxed{b = 5}$

$\boxed{b = -1}$

19) $8k^2 - 16k - 64 = 0$

$8(k^2 - 2k) = 64$

$8(k-1)^2 = 64 + 8$

$8(k-1)^2 = 72$

$(k-1)^2 = 9$

$k - 1 = \pm 3$

$k = 1 \pm 3$

$\boxed{k = 4}$

$\boxed{k = -2}$

20) $10x^2 + 20x - 38 = 0$

$10(x^2 + 2x) = 38$

$10(x+1)^2 = 38 + 10$

$10(x+1)^2 = 48$

$(x+1)^2 = 4.8$

$x + 1 = \pm\sqrt{4.8}$

$\boxed{x = -1 \pm \sqrt{4.8}}$

21) $2a^2 - 4a - 6 = 0$

$2(a^2 - 2a) = 6$

$2(a-1)^2 = 6 + 2$

$2(a-1)^2 = 8$

$(a-1)^2 = 4$

$a - 1 = \pm 2$

$a = 1 \pm 2$

$\boxed{a = 3}$

$\boxed{a = -1}$

22) $2x^2 + 20x + 22 = 0$

$2(x^2 + 10x) = -22$

$2(x+5)^2 = -22 + 50$

$2(x+5)^2 = 28$

$(x+5)^2 = 14$

$x + 5 = \pm\sqrt{14}$

$\boxed{x = -5 \pm \sqrt{14}}$

23) $7x^2 + 14x - 21 = 0$

$7(x^2 + 2x) = 21$

$7(x+1)^2 = 21 + 7$

$7(x+1)^2 = 28$

$(x+1)^2 = 4$

$x + 1 = \pm 2$

$x = -1 \pm 2$

$\boxed{x = 1}$

$\boxed{x = -3}$

24) $x^2 - 20x + 36 = 0$

$(x-10)^2 = -36 + 100$

$(x-10)^2 = 64$

$x - 10 = \pm 8$

$x = 10 \pm 8$

$\boxed{x = 18}$

$\boxed{x = 2}$

25) $4p^2 - 8p - 60 = 0$

$4(p^2 - 2p) = 60$

$4(p-1)^2 = 60 + 4$

$4(p-1)^2 = 64$

$(p-1)^2 = 16$

$p - 1 = \pm 4$

$p = 1 \pm 4$

$\boxed{p = 5}$

$\boxed{p = -3}$

26) $b^2 + 4b - 18 = 0$

$(b+2)^2 = 18 + 4$

$(b+2)^2 = 22$

$b + 2 = \pm\sqrt{22}$

$\boxed{b = -2 \pm \sqrt{22}}$

27) $10n^2 + 20n - 30 = 0$

$10(n^2+2n)=30$ $\quad n+1=\pm 2$

$10(n+1)^2=30+10$

$10(n+1)^2=40$ $\quad n=-1\pm 2$

$(n+1)^2=4$ $\quad \boxed{n=1}$ $\boxed{n=-3}$

28) $5n^2 - 10n - 100 = 0$

$5(n^2-2n)=100$

$5(n-1)^2=100+5$

$5(n-1)^2=105$

$(n-1)^2=21$ $\quad n-1=\pm\sqrt{21}$

$\boxed{n=1\pm\sqrt{21}}$

29) $n^2 - 18n - 22 = 0$

$(n-9)^2=22+81$

$(n-9)^2=103$

$n-9=\pm\sqrt{103}$

$\boxed{n=9\pm\sqrt{103}}$

30) $2m^2 + 8m - 3 = 0$

$2(m^2+4m)=3$

$2(m+2)^2=3+8$

$2(m+2)^2=11$ $\quad \boxed{m=-2\pm\sqrt{5.5}}$

$(m+2)^2=5.5$

31) $x^2 - 8x - 6 = 3$

$(x-4)^2=9+16$

$(x-4)^2=25$

$x-4=\pm 5$

$x=4\pm 5$ $\quad \boxed{x=9}$ $\boxed{x=-1}$

32) $10k^2 - 20k - 82 = -2$

$10(k^2-2k)=80$ $\quad k=1\pm 3$

$10(k-1)^2=80+10$ $\quad \boxed{k=4}$

$10(k-1)^2=90$ $\quad \boxed{k=-2}$

$(k-1)^2=9$

$k-1=\pm 3$

33) $n^2 - 16n + 17 = -8$

$(n-8)^2=-25+64$

$(n-8)^2=39$

$n-8=\pm\sqrt{39}$

$\boxed{n=8\pm\sqrt{39}}$

34) $10x^2 - 20x - 22 = 2$

$10(x^2-2x)=24$

$10(x-1)^2=24+10$

$10(x-1)^2=34$

$(x-1)^2=3.4$ $\quad \boxed{x=1\pm\sqrt{3.4}}$

$x-1=\pm\sqrt{3.4}$

35) $7x^2 + 14x - 54 = 2$

$7(x^2+2x)=56$ $\quad x=-1\pm 3$

$7(x+1)^2=63$ $\quad \boxed{x=2}$

$(x+1)^2=9$ $\quad \boxed{x=-4}$

$x+1=\pm 3$

36) $p^2 - 14p + 4 = 5$

$(p-7)^2=1+49$

$(p-7)^2=50$

$p-7=\pm 5\sqrt{2}$

$\boxed{p=7\pm 5\sqrt{2}}$

37) $9n^2 - 18n - 50 = 3$

$9(n^2-2n)=53$

$9(n-1)^2=53+9$

$9(n-1)^2=62$ $\quad \boxed{n=1\pm\sqrt{6.9}}$

$(n-1)^2=6.9$

38) $n^2 + 10n - 58 = 4$

$(n+5)^2=62$

$\boxed{n=-5\pm\sqrt{62}}$

39) $p^2 - 4p - 63 = -3$

$(p-2)^2=60+4$

$(p-2)^2=64$ $\quad \boxed{p=10}$ $\boxed{p=-6}$

$p-2=\pm 8$

$p=2\pm 8$

40) $m^2 + 10m - 17 = -6$

$(m+5)^2=11+25$

$(m+5)^2=36$ $\quad \boxed{m=1}$ $\boxed{m=-11}$

$m+5=\pm 6$

$m=-5\pm 6$