

Test Review Key (Many contain Errors  $\frac{1}{2}$ )

①  $x^2 - x - 2$

$(x-2)(x+1)$

Strategy: Find 2 numbers that multiply to give  $-2$ , but add to give  $-1$ . Those #s are  $-2$  &  $+1$

②  $x^2 - 8x - 20 \Rightarrow (x-10)(x+2)$

③  $x^2 - 5x - 36 \Rightarrow (x-9)(x+4)$

④  $x^2 + 8x - 10 \Rightarrow$  NOT factorable

⑤  $x^2 + 11x + 28 \Rightarrow (x+7)(x+4)$

⑥  $x^2 + 2x - 24 \Rightarrow (x+6)(x-4)$

⑦  $5x^2 + 18x + 9$

$x^2 + 18x + 45$

$\frac{(x+15)(x+3)}{5 \quad 5}$

$(x+3)(x+\frac{3}{5})$

$(x+3)(5x+3)$

Slide & Divide: Slide

- Factor
- divide
- Simplify
- move denominators

⑧  $6x^2 - 21x \Rightarrow 3x(2x-7)$

⑨  $10x^2 - x - 3$

$x^2 - x - 30$

$(x-6)(x+5)$

$(x-\frac{6}{10})(x+\frac{5}{10})$

$(x-\frac{3}{5})(x+\frac{1}{2})$

$(5x-3)(2x+1)$

⑩  $3x^2 + 2x - 8$

$x^2 + 2x - 24$

$(x+6)(x-4)$

$(x+\frac{6}{3})(x-\frac{4}{3})$

$(x+2)(x-\frac{4}{3})$

$(x+2)(3x-4)$

⑪  $2x^2 + 7x + 3$

$x^2 + 7x + 6$

$(x+1)(x+6)$

$(x+\frac{1}{2})(x+\frac{6}{2})$

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

$(2x+1)(x+3)$

⑫  ~~$8x^2 - 14x - 4$~~

~~$x^2 - 14x - 32$~~

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

~~$(x-2)(x+\frac{1}{4})$~~

~~$(x-2)(4x+1)$~~

$8x^2 - 14x - 4$

$2(4x^2 - 7x - 2)$

$2(x^2 - 7x - 8)$

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

$2(x-\frac{8}{4})(x+\frac{1}{4})$

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

25 a typo.

$$13. x^2 + 8x - 9 = 0$$

$$(x+9)(x-1) = 0$$

$$x+9=0 \quad x-1=0$$

$$x = -9 \quad x = 1$$

$$14. 2x^2 + x = 5$$

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

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

← Slide & Divide  
Not Factorable.

$$15. x^2 + 6x = 0$$

$$x(x+6) = 0$$

$$x=0 \quad x+6=0$$

$$x=0 \quad x=-6$$

$$16. 5x^2 + 12x + 4 = 0$$

$$x^2 + 12x + 20 = 0$$

$$(x+10)(x+2) = 0$$

$$(x + \frac{10}{5})(x + \frac{2}{5}) = 0$$

$$(x+2)(5x+2) = 0$$

$$x+2=0 \quad 5x+2=0$$

$$x = -2 \quad x = -\frac{2}{5}$$

$$17. 2x^2 = 5x + 12$$

$$2x^2 - 5x - 12 = 0$$

$$x^2 - 5x - 24 = 0$$

$$(x-8)(x+3) = 0$$

$$(x - \frac{8}{2})(x + \frac{3}{2}) = 0$$

$$(x-4)(2x+3) = 0$$

$$x-4=0 \quad 2x+3=0$$

$$x=4 \quad x = -\frac{3}{2}$$

$$18. 30x + 25 = -9x^2$$

$$9x^2 + 30x + 25 = 0$$

$$x^2 + 30x + 225 = 0$$

$$(x+15)^2 = 0$$

$$x+15=0$$

$$x = -15$$

$$19. \sqrt{18} = \sqrt{9 \cdot 2} = \sqrt{9} \sqrt{2} = 3\sqrt{2}$$

$$20. \sqrt{150} = \sqrt{25 \cdot 6} = \sqrt{25} \sqrt{6} = 5\sqrt{6}$$

$$21. \sqrt{605} = \sqrt{121 \cdot 5} = \sqrt{121} \sqrt{5} = 11\sqrt{5}$$

$$22. \sqrt{6} \sqrt{20} = \sqrt{120} = \sqrt{4 \cdot 30} = \sqrt{4} \sqrt{30} = 2\sqrt{30}$$

$$23. \sqrt{180} = \sqrt{36 \cdot 5} = \sqrt{36} \sqrt{5} = 6\sqrt{5}$$

$$24. \sqrt{84} = \sqrt{4 \cdot 21} = \sqrt{4} \sqrt{21} = 2\sqrt{21}$$

$$(25) \quad 5x^2 - 4 = 16$$

$$5x^2 = 20$$

$$\sqrt{x^2} = \sqrt{4}$$

$$x = \pm \sqrt{4}$$

$$x = \pm 2$$

$$(26) \quad (x+2)^2 = 49$$

$$x+2 = \pm \sqrt{49}$$

$$x = \pm 7 - 2$$

$$x = -2 \pm 7$$

$$x = -2 + 7$$

$$= 5$$

$$x = -2 - 7$$

$$= -9$$

$$(27) \quad 2(3x+4)^2 - 5 = 45$$

$$2(3x+4)^2 = 50$$

$$(3x+4)^2 = 25$$

$$3x+4 = \pm \sqrt{25}$$

$$3x = -4 \pm 5$$

$$x = \frac{-4 \pm 5}{3}$$

$$(28) \quad \frac{3}{4}x^2 - 19 = 26$$

$$\frac{3}{4}x^2 = 45$$

$$x^2 = 60$$

$$x = \pm \sqrt{60}$$

$$= \pm \sqrt{4 \cdot 15}$$

$$= \pm \sqrt{4} \sqrt{15}$$

$$= \pm 2\sqrt{15}$$

$$(29) \quad 6(x-5)^2 + 1 = 19$$

$$6(x-5)^2 = 18$$

$$(x-5)^2 = 3$$

$$x-5 = \pm \sqrt{3}$$

$$x = 5 \pm \sqrt{3}$$

$$(30) \quad 8 - 10x^2 = -22$$

$$-10x^2 = -30$$

$$x^2 = 3$$

$$x = \pm \sqrt{3}$$

$$(31) \quad \sqrt{-16} = \sqrt{16 \cdot -1} = \sqrt{16} \sqrt{-1} = 4i$$

$$(32) \quad \sqrt{-98} = \sqrt{49 \cdot 2 \cdot -1} = \sqrt{49} \sqrt{2} \sqrt{-1} = 7\sqrt{2}i$$

$$(33) \quad \sqrt{-448} = \sqrt{64 \cdot 7 \cdot -1} = \sqrt{64} \sqrt{7} \sqrt{-1} = 8\sqrt{7}i$$

$$(34) \quad \sqrt{-363} = \sqrt{121 \cdot 3 \cdot -1} = \sqrt{121} \sqrt{3} \sqrt{-1} = 11\sqrt{3}i$$

$$(35) \quad (5-8i) - (-2+i) = 5 - (-2) - 8i - i = 7-9i$$

$$(36) \quad 6 + (18-i) - (2+12i)$$

$$6 + 18 - 2 - i - 12i$$

$$22 - 13i$$

$$(37) \quad (4+6i) + (17-9i) = 21-3i$$

$$(38) \quad (-16+2i) + (13-2i) = -16+13 + 2i-2i = -3$$

$$\begin{aligned}
 (39) \quad (2+3i)(-1+5i) &= -2+10i-3i+15i^2 \\
 &= -2+7i-15 \\
 &= -17+7i
 \end{aligned}$$

$$\begin{aligned}
 (40) \quad -2i(4+9i) &= -8i-18i^2 \\
 &= 18-8i
 \end{aligned}$$

$$\begin{aligned}
 (41) \quad (9+i)(8-12i) &= 72-108i+8i-12i^2 \\
 &= 72-100i+12 \\
 &= 84-100i
 \end{aligned}$$

$$(42) \quad \frac{4+9i}{3i} \cdot \frac{-3i}{-3i} = \frac{-12i-27i^2}{-9i^2} = \frac{27-12i}{9} =$$

$$\frac{27}{9} - \frac{12i}{9} = 3 - \frac{4}{3}i$$

$$(43) \quad \frac{8+i}{6-4i} \cdot \frac{6+4i}{6+4i} = \frac{(8+i)(6+4i)}{36+16i} = \frac{48+32i+6i+4i^2}{52}$$

$$= \frac{48+38i-4}{52} = \frac{44+38i}{52} = \frac{44}{52} + \frac{38}{52}i = \frac{11}{13} + \frac{19}{26}i$$

$$(44) \quad \frac{2-i}{2+i} \cdot \frac{2-i}{2-i} = \frac{(2-i)(2-i)}{4+1} = \frac{4-2i-2i+i^2}{5} =$$

$$\frac{4-4i-1}{5} = \frac{3-4i}{5} = \frac{3}{5} - \frac{4}{5}i$$

$$\begin{aligned} 45. \quad \sqrt{(x+1)^2} &= \sqrt{121} \\ x+1 &= \pm\sqrt{121} \\ x+1 &= \pm 11 \\ x &= -1 \pm 11 \end{aligned}$$

$$\begin{aligned} 46. \quad (x-9)^2 - 2 &= -82 \\ \sqrt{(x-9)^2} &= \sqrt{-80} \\ x-9 &= \pm\sqrt{-80} \\ x &= 9 \pm 4\sqrt{5}i \end{aligned}$$

$\sqrt{-80} = \sqrt{16 \cdot 5 \cdot -1} = 4\sqrt{5}i$

$$\begin{aligned} 47. \quad \frac{-3(x+6)^2}{-3} &= \frac{36}{-3} \\ (x+6)^2 &= -12 \\ x+6 &= \pm\sqrt{-12} \\ x &= -6 \pm 2\sqrt{3}i \end{aligned}$$

$$\begin{aligned} 48. \quad -(6x+5)^2 + 4 &= 76 \\ -(6x+5)^2 &= 72 \\ (6x+5)^2 &= -72 \\ 6x+5 &= \pm\sqrt{-72} \\ 6x &= -5 \pm 6\sqrt{2}i \\ x &= \frac{-5 \pm 6\sqrt{2}i}{6} = \frac{-5}{6} \pm \sqrt{2}i \end{aligned}$$

$$\begin{aligned} 49. \quad -\frac{1}{2}(3x+8)^2 - 16 &= 2 \\ -\frac{1}{2}(3x+8)^2 &= 18 \\ (3x+8)^2 &= -36 \\ 3x+8 &= \pm\sqrt{-36} \\ 3x &= -8 \pm 6i \\ x &= \frac{-8}{3} \pm 2i \end{aligned}$$

$$\begin{aligned} 50. \quad x^2 + 10x + 21 &= 0 \\ x^2 + 10x &= -21 \end{aligned} \quad \left(\frac{b}{2}\right)^2 = \left(\frac{10}{2}\right)^2 = 5^2 = 25$$

$$51. \quad x^2 - 5x = 12 \quad \left(\frac{b}{2}\right)^2 = \left(\frac{-5}{2}\right)^2 = \frac{25}{4}$$

$$\begin{aligned} 52. \quad x^2 + 6x + 9 &= 0 \\ x^2 + 6x &= -9 \end{aligned} \quad \left(\frac{b}{2}\right)^2 = \left(\frac{6}{2}\right)^2 = 3^2 = 9$$

$$\begin{aligned} 53. \quad x^2 - 9x - 5 &= 23 \\ x^2 - 9x &= 28 \\ x^2 - 9x + \frac{81}{4} &= 28 + \frac{81}{4} \\ \left(x - \frac{9}{2}\right)^2 &= \frac{193}{4} \\ x - \frac{9}{2} &= \pm\sqrt{\frac{193}{4}} \end{aligned} \quad x = \frac{9}{2} \pm \frac{\sqrt{193}}{2}$$

$$\begin{aligned}
 (54) \quad x^2 + 10x + 29 &= 0 & \left(\frac{b}{2}\right)^2 &= \left(\frac{10}{2}\right)^2 = 5^2 = 25 \\
 x^2 + 10x &= -29 \\
 x^2 + 10x + 25 &= -29 + 25 \\
 (x+5)^2 &= -4 \\
 x+5 &= \pm\sqrt{-4} \\
 x &= -5 \pm 2i
 \end{aligned}$$

$$\begin{aligned}
 (55) \quad x^2 - 14x + 9 &= -60 & \left(\frac{b}{2}\right)^2 &= \left(\frac{-14}{2}\right)^2 = (-7)^2 = 49 \\
 x^2 - 14x &= -69 \\
 x^2 - 14x + 49 &= -69 + 49 \\
 (x-7)^2 &= -20 \\
 x-7 &= \pm\sqrt{-20} \\
 x &= 7 \pm 2\sqrt{5}i
 \end{aligned}$$

$$\begin{aligned}
 (56) \quad x^2 - 20x &= 60 & \left(\frac{b}{2}\right)^2 &= \left(\frac{-20}{2}\right)^2 = (-10)^2 = 100 \\
 x^2 - 20x + 100 &= 60 + 100 \\
 (x-10)^2 &= 160 \\
 x-10 &= \pm\sqrt{160} \\
 x &= 10 \pm 4\sqrt{10}
 \end{aligned}$$

$$\begin{aligned}
 (57) \quad 5x^2 + 29x - 6 &= 0 \\
 5x^2 + 29x &= 6 && \text{Factor out 5} \\
 5\left(x^2 + \frac{29}{5}x\right) &= 6 && \text{divide by 5 on both sides} \\
 x^2 + \frac{29}{5}x &= \frac{6}{5} \\
 x^2 + \frac{29}{5}x + \frac{841}{100} &= \frac{6}{5} + \frac{841}{100} && \text{complete square.} \\
 \left(x + \frac{29}{10}\right)^2 &= \frac{961}{100} && \left(\frac{29}{5}\right)^2 = \left(\frac{29}{10}\right)^2 = \frac{841}{100} \\
 x + \frac{29}{10} &= \pm\sqrt{\frac{961}{100}} \\
 x &= -\frac{29}{10} \pm \frac{31}{10}
 \end{aligned}$$

$$(58.) \quad 2x^2 - x - 6 = 0$$

$$2x^2 - x = 6$$

$$2(x^2 - \frac{1}{2}x) = 6$$

$$x^2 - \frac{1}{2}x = 3$$

$$x^2 - \frac{1}{2}x + \frac{1}{16} = 3 + \frac{1}{16}$$

$$(x - \frac{1}{4})^2 = \frac{49}{16}$$

$$x - \frac{1}{4} = \pm \sqrt{\frac{49}{16}}$$

$$(\frac{1}{2})^2 = (\frac{-1}{2})^2 = (-\frac{1}{4})^2 = \frac{1}{16}$$

$$x = \frac{1}{4} \pm \frac{7}{4}$$

$$(59.) \quad -3x^2 + 4x + 15 = 0$$

$$-3x^2 + 4x = -15$$

$$-3(x^2 - \frac{4}{3}x) = -15$$

$$x^2 - \frac{4}{3}x = 5$$

$$x^2 - \frac{4}{3}x + \frac{4}{9} = 5 + \frac{4}{9}$$

$$(x - \frac{2}{3})^2 = \frac{49}{9}$$

$$x - \frac{2}{3} = \pm \sqrt{\frac{49}{9}}$$

$$(\frac{1}{2})^2 = (\frac{-4}{2})^2 = (-\frac{2}{3})^2 = \frac{4}{9}$$

$$x = \frac{2}{3} \pm \frac{7}{3}$$

$$(60.) \quad -4x^2 + 24x - 100 = 0$$

$$\frac{-4(x^2 - 6x + 25) = 0}{-4 \quad -4}$$

$$x^2 - 6x + 25 = 0$$

$$(\frac{1}{2})^2 = (\frac{-6}{2})^2 = (-3)^2 = 9$$

$$x^2 - 6x = -25$$

$$x^2 - 6x + 9 = -25 + 9$$

$$(x - 3)^2 = -16$$

$$x - 3 = \pm \sqrt{-16}$$

$$x = 3 \pm 4i$$

$$(61.) \quad -2x^2 + x + 5 = 0$$

$$a = -2 \quad b = 1 \quad c = 5$$

$$x = \frac{-1 \pm \sqrt{1^2 - 4(-2)(5)}}{2(-2)} = \frac{-1 \pm \sqrt{41}}{-4}$$

$$x = \frac{-1}{-4} \pm \frac{\sqrt{41}}{-4} = \frac{1}{4} \pm \frac{\sqrt{41}}{-4}$$

62.  $4x^2 - 13x - 12 = 0$        $x = \frac{+13 \pm \sqrt{(-13)^2 - 4(4)(-12)}}{2(4)}$   
 $a=4$   $b=-13$   $c=-12$

$x = \frac{13 \pm \sqrt{361}}{8} = \frac{13 \pm 19}{8}$

$x = \frac{13+19}{8} = 4$

$x = \frac{13-19}{8} = \frac{-3}{4}$

63.  $x^2 - 14x + 49 = 0$        $\frac{+14 \pm \sqrt{(-14)^2 - 4(1)(49)}}{2(1)}$   
 $a=1$   $b=-14$   $c=49$

$x = \frac{14 \pm \sqrt{0}}{2} = \frac{14}{2} = 7$

64.  $y = \frac{1}{2}(x+3)^2 - 8$   
 ↳ down 8  
 ↳ left + 3  
 ↳ V. Shrink by  $\frac{1}{2}$

65.  $y = -3(x-4)^2 + 12$   
 ↳ up 12  
 ↳ Right 4  
 ↳ V. Stretch by 3  
 ↳ Reflect about x-axis

66.  $y = (x+2)^2$   
 ↳ left 2

67.  $y = -x^2 - 6$   
 ↳ down 6  
 ↳ Reflect about x-axis



68.  $y = 5(x+7)^2 + 9$

↳ U. Stretch by 5  
 ↳ left 7  
 ↳ up 9

69.  $y = (x+5)^2$  Vertex:  $(-5, 0)$

70.  $y = -\frac{1}{2}(x-14)^2 + 1$  Vertex:  $(14, 1)$

71.  $y = 9(x-2)^2 - 9$  Vertex:  $(2, -9)$

72.  $y = 2x^2 - 12x + 5$

$\frac{-b}{2a} = \frac{12}{4} = 3$  →  $y = 2(3)^2 - 12(3) + 5$   
 $= 18 - 36 + 5$   
 $= -13$

Vertex:  $(3, -13)$

73.  $y = x^2 + 4x + 5$

$\frac{-b}{2a} = \frac{-4}{2} = -2$  →  $y = (-2)^2 + 4(-2) + 5$   
 $= 4 - 8 + 5$   
 $= 1$

Vertex:  $(-2, 1)$

74.  $y = -5x^2 + 10x - 7$

$\frac{-b}{2a} = \frac{-10}{2(-5)} = 1$  →  $y = -5(1)^2 + 10(1) - 7$   
 $= -5 + 10 - 7$   
 $= -2$

Vertex:  $(1, -2)$