

12A

$$1) \frac{-(6) \pm \sqrt{(6)^2 - 4(1)(2)}}{2(1)} =$$

$$\frac{-6 \pm \sqrt{28}}{2} = \frac{-6 \pm 2\sqrt{7}}{2} = -3 \pm \sqrt{7}$$

$$2) (X - 4)(X - 1) = 0$$

$$X - 4 = 0 \quad X - 1 = 0$$

$$X = 4 \quad X = 1$$

$$3) \frac{-(-7) \pm \sqrt{(-7)^2 - 4(3)(-1)}}{2(3)} = \frac{-7 \pm \sqrt{61}}{6}$$

$$4) A^2 - 10A - 11 = 0$$

$$(A - 11)(A + 1) = 0$$

$$A - 11 = 0 \quad A + 1 = 0$$

$$A = 11 \quad A = -1$$

$$5) 2Q^2 - 17Q + 2 = 0$$

$$\frac{-(-17) \pm \sqrt{(-17)^2 - 4(2)(2)}}{2(2)} = \frac{17 \pm \sqrt{273}}{4}$$

$$6) X^2 + 3X + 2 = 0$$

$$(X + 1)(X + 2) = 0$$

$$X + 1 = 0 \quad X + 2 = 0$$

$$X = -1 \quad X = -2$$

$$7) R^2 - 2R + 6 = 0$$

$$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(6)}}{2(1)} =$$

$$\frac{2 \pm \sqrt{20}}{2} = \frac{2 \pm 2i\sqrt{5}}{2} = 1 \pm i\sqrt{5}$$

$$8) 8X^2 - X - 2 = 0$$

$$\frac{-(-1) \pm \sqrt{(-1)^2 - 4(8)(-2)}}{2(8)} = \frac{1 \pm \sqrt{65}}{16}$$

$$9) \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-8)}}{2(2)} = \frac{-3 \pm \sqrt{73}}{4}$$

$$10) 4Y^2 - 3Y - 8 = 0$$

$$\frac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(-8)}}{2(4)} = \frac{3 \pm \sqrt{137}}{8}$$

12B

$$1) \frac{-(-1) \pm \sqrt{(-1)^2 - 4(8)(-3)}}{2(8)} = \frac{1 \pm \sqrt{97}}{16}$$

$$6) 5X^2 + X + 25 = 0$$

$$\frac{-(-1) \pm \sqrt{(-1)^2 - 4(5)(25)}}{2(5)} = \frac{-1 \pm i\sqrt{499}}{10}$$

$$2) 2X^2 + X - 7 = 0$$

$$\frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-7)}}{2(2)} = \frac{-1 \pm \sqrt{57}}{4}$$

$$7) 2X^2 + 4X - 3 = 0$$

$$\frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-3)}}{2(2)} =$$

$$\frac{-4 \pm \sqrt{40}}{4} = \frac{-4 \pm 2\sqrt{10}}{4} = \frac{-2 \pm \sqrt{10}}{2}$$

$$3) \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(3)}}{2(1)} = \frac{6 \pm \sqrt{24}}{2} =$$

$$8) \frac{-(-2) \pm \sqrt{(-2)^2 - 4(5)(-1)}}{2(5)} = \frac{-2 \pm \sqrt{24}}{10} =$$

$$\frac{-2 \pm 2\sqrt{6}}{10} = \frac{-1 \pm \sqrt{6}}{5}$$

$$4) 4X^2 + 3X + 2 = 0$$

$$\frac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(2)}}{2(4)} = \frac{-3 \pm \sqrt{23}}{8} =$$

$$9) 3X^2 + 5X = 0$$

$$X(3X + 5) = 0$$

$$X = 0 \quad 3X + 5 = 0$$

$$X = 0, -5/3$$

$$5) P^2 - P - 2 = 0$$

$$(P - 2)(P + 1) = 0$$

$$P - 2 = 0 \quad P + 1 = 0$$

$$P = 2 \quad P = -1$$

$$10) \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

12C

- 1) $(X - 3)(X - 2) = 0$
 $X = 3 \quad X = 2$
- 2) $\frac{-4 \pm \sqrt{4^2 - 4 \cdot 1 \cdot 2}}{2 \cdot 1} = \frac{-4 \pm 2\sqrt{2}}{2} = -2 \pm \sqrt{2}$
- 3) $X^2 + 3X + 1 = 0$
 $\frac{-3 \pm \sqrt{3^2 - 4 \cdot 1 \cdot 1}}{2 \cdot 1} = \frac{-3 \pm \sqrt{5}}{2}$
- 4) $(X + 6)(X - 2) = 0$
 $X = -6 \quad X = 2$
- 5) $\frac{-2 \pm \sqrt{2^2 - 4 \cdot 2 \cdot 5}}{2 \cdot 2} = \frac{-2 \pm \sqrt{-36}}{4} = \frac{-2 \pm 6i}{4} = \frac{-1 \pm 3i}{2}$
- 6) $X^2 + 8X + 16 = 0$
 $(X + 4)(X + 4) = 0 \quad X = -4$
- 7) 169
- 8) $2X^2 + 9X + \frac{1}{4}$
 $X^2 + 9/2 X + \frac{1}{4}$
 $X^2 + 9/2 X + 81/16$
 $2X^2 + 9X + 81/8$
- 9) 40X
- 10) $2\sqrt{14} X$
- 11) $X^2 + 1/3 X - 4/3 = 0$
 $X^2 + 1/3 X + 1/36 = 4/3 + 1/36$
 $(X + 1/6)^2 = 48/36 + 1/36$
 $\sqrt{(X + 1/6)^2} = \sqrt{49/36}$
 $X + 1/6 = \pm 7/6$
 $X = -1/6 + 7/6 \quad X = -1/6 - 7/6$
 $X = 6/6 = 1 \quad X = -8/6 = -4/3$
- 12) $1^2 + 1/3(1) - 4/3 = 0$
 $4/3 - 4/3 = 0$
 $(-4/3)^2 + 1/3(-4/3) - 4/3 = 0$
 $16/9 - 4/9 - 12/9 = 0$
- 13) $X^6 + 6X^5(-A) + 15X^4(-A)^2 + 20X^3(-A)^3 + 15X^2(-A)^4 + 6X(-A)^5 + (-A)^6 =$
 $X^6 - 6X^5A + 15X^4A^2 - 20X^3A^3 + 15X^2A^4 - 6XA^5 + A^6$
- 14) $4/1(1/2X)^3(-3A)^1 = 4(1/8X)^3(-3A) =$
 $-3/2 X^3A$
- 15) $5^3 + 3(5)^2(-2A) + 3(5)(-2A)^2 + (-2A)^3 =$
 $125 - 150A + 60A^2 - 8A^3$
- 16) $(X - 2Y)^3$
- 17) $\frac{(6 + 5i)(3i + 2)}{(3i - 2)(3i + 2)} =$
 $\frac{18i + 15i^2 + 12 + 10i}{9i^2 - 4} = \frac{28i - 3}{-13}$
- 18) $\frac{(2 + \sqrt{-49})(2 + \sqrt{-49})}{(2 - \sqrt{-49})(2 + \sqrt{-49})}$
 $\frac{4 + 4\sqrt{-49} - 49 - 45 + 4 \cdot 7i}{4 - (-49)} = \frac{-45 + 28i}{53}$
- 19) $\frac{2(3 + \sqrt{7})}{(3 - \sqrt{7})(3 + \sqrt{7})} = \frac{6 + 2\sqrt{7}}{9 - 7} =$
 $\frac{6 + 2\sqrt{7}}{2} = 3 + \sqrt{7}$
- 20) $\frac{(2 + \sqrt{5})(2\sqrt{5} + 4)}{(2\sqrt{5} - 4)(2\sqrt{5} + 4)} =$
 $\frac{4\sqrt{5} + 8 + 2 \cdot 5 + 4\sqrt{5}}{4 \cdot 5 - 16} = \frac{8\sqrt{5} + 18}{4} = \frac{4\sqrt{5} + 9}{2}$

12D

- 1) $\frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(-7)}}{2(2)} = \frac{9 \pm \sqrt{137}}{4}$
- 2) $\frac{-5 \pm \sqrt{5^2 - 4(1)(-2)}}{2} = \frac{-5 \pm \sqrt{33}}{2}$
- 3) $(3X + 4)(X + 1) = 0$
 $X = -4/3, -1$
- 4) $\frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(12)}}{2(1)} = \frac{6 \pm \sqrt{-12}}{2} =$
 $\frac{6 \pm 2i\sqrt{3}}{2} = 3 \pm i\sqrt{3}$
- 5) $(5X + 2)(X - 1) = 0$
 $X = -2/5, 1$
- 6) $4X^2 - 4X + 1 = 0$
 $(2X - 1)(2X - 1) = 0 \quad X = 1/2$
- 7) 25/4
- 8) 1/16
- 9) $25X^2 + \underline{\hspace{1cm}} + 1$
 $X^2 + \underline{\hspace{1cm}} + 1/25$
 $X^2 + 2/5 X + 1/25$
 $25X^2 + 10X + 1$
- 10) $49X^2 - \underline{\hspace{1cm}} + 4$
 $X^2 - \underline{\hspace{1cm}} + 4/49$
 $X^2 - 4/7 X + 4/49$
 $49X^2 - 28X + 4$
- 11) $(X - 10)(X - 2) = 0$
 $X = 10, 2$
- 12) $(10)^2 - 12(10) + 20 = 0$
 $100 - 120 + 20 = 0$
 $(2)^2 - 12(2) + 20 = 0$
 $4 - 24 + 20 = 0$
- 13) $X^4 + 4X^3 + 6X^2 + 4X + 1$
- 14) $\frac{4 \cdot 3 \cdot 2 \cdot 1}{1 \cdot 2 \cdot 3 \cdot 4} (1/2 X)^0 (3A)^4 = 81A^4$
- 15) $10^3 + 3(10)^2(-1/X) + 3(10)(-1/X)^2 + (-1/X)^3$
 $1000 - 300/X + 30/X^2 - 1/X^3$
- 16) $(X + 2)^3$
- 17) $\frac{(4 - 3i)(i)}{(2i)(i)} = \frac{4i - 3i^2}{2i^2} =$
 $\frac{4i + 3}{-2}$
- 18) $\frac{(10 + \sqrt{-A})(10 + \sqrt{-A})}{(10 - \sqrt{-A})(10 + \sqrt{-A})}$
 $\frac{100 + 20i\sqrt{-A} - A}{100 - (-A)} =$
 $\frac{100 + 20i\sqrt{-A} - A}{100 + A}$
- 19) $\frac{(9)(7 - \sqrt{10})}{(7 + \sqrt{10})(7 - \sqrt{10})} = \frac{63 - 9\sqrt{10}}{49 - \sqrt{10}} =$
 $\frac{63 - 9\sqrt{10}}{39} = \frac{21 - 3\sqrt{10}}{13}$
- 20) $\frac{(4 - \sqrt{6})(3\sqrt{7} - 5)}{(3\sqrt{7} + 5)(3\sqrt{7} - 5)} =$
 $\frac{12\sqrt{7} - 20 - 3\sqrt{42} + 5\sqrt{6}}{9(7) - 25} =$
 $\frac{12\sqrt{7} - 20 - 3\sqrt{42} + 5\sqrt{6}}{38}$

12E

- 1) $(X + 4)(X - 2) = 0$
 $X = -4 \quad X = 2$
- 2) $X - 6X + 8 = 0$
 $(X - 4)(X - 2) = 0$
 $X = 4, 2$
- 3) $(2X - 1)(X - 7) = 0$
 $X = 1/2, 7$
- 4) $3X^2 + 4X - 7 = 0$
 $(3X + 7)(X - 1) = 0$
 $3X + 7 = 0; \quad X - 1 = 0$
 $3X = -7 \quad X = 1$
 $X = -7/3$
- 5) $X^2 + 5X - 2 = 0$
 $\frac{-5 \pm \sqrt{5^2 - 4(1)(-2)}}{2(1)} = \frac{-5 \pm \sqrt{33}}{2}$
- 6) $(X + 5)(X - 3) = 0$
 $X = -5, 3$
- 7) $\frac{4X^2 + 28X + \frac{49}{4}}{4} = \frac{49}{4}$
 $X^2 + 7X + \frac{49}{4} = \frac{49}{4}$

You might want to leave it in this reduced form if you were going on to solve the equation.

or, $4X^2 + 28X + 49$

$$8) \frac{9X^2 - 36X + \frac{9}{9}}{9} = \frac{9}{9}$$

$$X^2 - 4X + 4$$

$$\text{or, } 9X^2 - 36X + 36$$

$$9) 60X$$

$$10) 198X$$

$$11) (X + 7)(X - 2) = 0$$

$$X = -7, 2$$

$$12) (-7)^2 + 5(-7) - 14 = 0$$

$$49 - 35 - 14 = 0$$

$$(2)^2 + 5(2) - 14 = 0$$

$$4 + 10 - 14 = 0$$

13A

$$1) 6^2 - 4(1)(9) = 0$$

$$\text{real, rational, equal (double root)}$$

$$(X + 3)(X + 3) = 0$$

$$X = -3$$

$$2) 7^2 - 4(2)(3) = 25$$

$$\text{real, rational, unequal}$$

$$(2X + 1)(X + 3) = 0$$

$$2X + 1 = 0 \quad X + 3 = 0$$

$$X = -1/2 \quad X = -3$$

$$3) -2X^2 + 3X + 6 = 0$$

$$(3)^2 - 4(-2)(6) = 57$$

$$\text{real, irrational, unequal}$$

$$\frac{-3 \pm \sqrt{57}}{2(-2)} = \frac{-3 \pm \sqrt{57}}{-4}$$

$$4) (-2)^2 - 4(3)(5) = -56$$

$$\text{imaginary}$$

$$\frac{-(-2) \pm \sqrt{-56}}{2(3)} = \frac{2 \pm 2i\sqrt{14}}{6} = \frac{1 \pm i\sqrt{14}}{3}$$

$$5) 7X^2 - 3X - 20 = 0$$

$$(-3)^2 - 4(7)(-20) = 569$$

$$\text{real, irrational, unequal}$$

$$\frac{-(-3) \pm \sqrt{569}}{2(7)} = \frac{3 \pm \sqrt{569}}{14}$$

13B

$$1) 2R^2 + 5R - 3 = 0$$

$$5^2 - 4(2)(-3) = 49$$

$$\text{real, rational, unequal}$$

$$(2R - 1)(R + 3) = 0$$

$$2R - 1 = 0 \quad R + 3 = 0$$

$$R = 1/2 \quad R = -3$$

$$2) X^2 + 8X + 16 = 0$$

$$8^2 - 4(1)(16) = 0$$

$$\text{real, rational, equal (double roots)}$$

$$(X + 4)(X + 4) = 0$$

$$X = -4$$

$$3) 6Y^2 + 7Y + 11 = 0$$

$$7^2 - 4(6)(11) = -215$$

$$\text{imaginary}$$

$$\frac{-7 \pm \sqrt{-215}}{2(6)} = \frac{-7 \pm i\sqrt{215}}{12}$$

$$4) 4X^2 + 5X + 1 = 0$$

$$5^2 - 4(4)(1) = 9$$

$$\text{real, rational, unequal}$$

$$(4X + 1)(X + 1) = 0$$

$$4X + 1 = 0 \quad X + 1 = 0$$

$$X = -1/4 \quad X = -1$$

$$5) (-5)^2 - 4(6)(-3) = 97$$

$$\text{real, irrational, unequal}$$

$$\frac{-(-5) \pm \sqrt{97}}{2(6)} = \frac{5 \pm \sqrt{97}}{12}$$