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

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

$X = 4 \qquad X = 1$

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

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

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

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

$A = 11 \qquad A = -1$

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

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

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

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

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

$X = -1 \qquad X = -2$

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

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

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

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

$\frac{6 \pm 2\sqrt{6}}{2} = 3 \pm \sqrt{6}$

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

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

$\frac{-3 \pm i\sqrt{23}}{8}$

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

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

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

$P = 2 \qquad P = -1$

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

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

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

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

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

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

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

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

$X(3X + 5) = 0$

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

$X = 0, -5/3$

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) $X^2 + 8X + 16 = 0$
$(X + 4)(X + 4) = 0 \qquad X = -4$

7) 169

8) $2X^2 + 9X + \_\_\_\_$
$X^2 + 9/2\ X + \_\_\_\_$
$X^2 + 9/2\ X + 81/16$
$2X^2 + 9X + 81/8$

9) $40X$

10) $2\sqrt{14}\ X$

11) $X^2 + 1/3\ X - 4/3 = 0$
$X^2 + 1/3\ X + 1/36 = 4/3 + 1/36$
$(X + 1/6)^2 = 48/36 + 1/36$
$\sqrt{(X + 1/6)^2} = \sqrt{49/36}$
$X + 1/6 = \pm 7/6$
$X = -1/6 + 7/6 \qquad X = -1/6 - 7/6$
$X = 6/6 = 1 \qquad X = -8/6 = -4/3$

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) $(X - 2Y)$

17) $\frac{(6 + 5i)(3i + 2)}{(3i - 2)(3i + 2)} =$
$\frac{18i + 15i^2 + 12 + 10i}{9i^2 - 4} = \frac{28i - 3}{-13}$

18) $\frac{(2 + \sqrt{-49})(2 + \sqrt{-49})}{(2 - \sqrt{-49})(2 + \sqrt{-49})}$
$\frac{4 + 4\sqrt{49} - 49}{4 - (-49)} = \frac{-45 + 4 \cdot 7i}{53} =$
$\frac{-45 + 28i}{53}$

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) $4X^2 - 4X + 1 = 0$
$(2X - 1)(2X - 1) = 0 \qquad X = 1/2$

7) 25/4

8) 1/16

9) $25X^2 + \_\_\_ + 1$
$X^2 + \_\_\_ + 1/25$
$X^2 + 2/5\ X + 1/25$
$25X^2 + 10X + 1$

10) $49X^2 - \_\_\_ + 4$
$X^2 - \_\_\_ + 4/49$
$X^2 - 4/7\ X + 4/49$
$49X^2 - 28X + 4$

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) $(X + 2)$

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) $3X^2 + 4X - 7 = 0$
$(3X + 7)(X - 1) = 0$
$3X + 7 = 0; \quad X - 1 = 0$
$3X = -7 \qquad X = 1$
$X = -7/3$

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) $\frac{4X^2}{4} + \frac{28X}{4} + \_\_\_\_$
$X^2 + 7X + \frac{49}{4}$
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) $\frac{9X^2}{9} - \frac{36X}{9} + \_\_\_\_$
$X^2 - 4X + 4$
or, $9X^2 - 36X + 36$

9) $60X$

10) $198X$

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

12) $(-7)^2 + 5(-7) - 14 = 0$,
$49 - 35 - 14 = 0$
$(2)^2 + 5(2) - 14 = 0$
$4 + 10 - 14 = 0$

13) $(2X)^5 + 5(2X)^4 + 10(2X)^3 + 10(2X)^2 + 5(2X) + 1$
$32X^5 + 80X^4 + 80X^3 + 40X^2 + 10X + 1$

14) $\frac{5 \cdot 4}{1 \cdot 2}(1/3\ X)^3(2)^2 = 10(1/27)X^3(4) =$
$40/27\ X^3$

15) $X^3 + 3X^2(-3/5) + 3X(-3/5)^2 + (-3/5)^3 =$
$X^3 - 9/5\ X^2 + 27/25\ X - 27/125$

16) $(2X + 1)$

17) $\frac{(10 + i)i}{(5i)i} = \frac{10i - 1}{-5}$

18) $\frac{(10)(5 + \sqrt{8})}{(5 - \sqrt{8})(5 + \sqrt{8})}$
$\frac{50 + 10\sqrt{8}}{25 - 8} = \frac{50 + 10\sqrt{4}\sqrt{2}}{17} =$
$\frac{50 + 20\sqrt{2}}{17}$

19) $\frac{(2 + 3\sqrt{6})(1 + \sqrt{6})}{(1 - \sqrt{6})(1 + \sqrt{6})} =$
$\frac{2 + 2\sqrt{6} + 3\sqrt{6} + 18}{1 - 6} =$
$\frac{20 + 5\sqrt{6}}{-5} = -4 - \sqrt{6}$

20) $\frac{(6 - \sqrt{2})(10\sqrt{3} + 8)}{(10\sqrt{3} - 8)(10\sqrt{3} + 8)} =$
$\frac{60\sqrt{3} + 48 - 10\sqrt{6} - 8\sqrt{2}}{100(3) - 64} =$
$\frac{30\sqrt{3} + 24 - 5\sqrt{6} - 4\sqrt{2}}{118}$

13A

1) $6^2 - 4(1)(9) = 0$
real, rational, equal (double root)
$(X + 3)(X + 3) = 0$
$X = -3$

2) $7^2 - 4(2)(3) = 25$
real, rational, unequal
$(2X + 1)(X + 3) = 0$
$2X + 1 = 0 \quad X + 3 = 0$
$X = -1/2 \quad X = -3$

3) $-2X^2 + 3X + 6 = 0$
$(3)^2 - 4(-2)(6) = 57$
real, irrational, unequal
$\frac{-3 \pm \sqrt{57}}{2(-2)} = \frac{-3 \pm \sqrt{57}}{-4}$

4) $(-2)^2 - 4(3)(5) = -56$
imaginary
$\frac{-(-2) \pm \sqrt{-56}}{2(3)} = \frac{2 \pm 2i\sqrt{14}}{6} = \frac{1 \pm i\sqrt{14}}{3}$

5) $7X^2 - 3X - 20 = 0$
$(-3)^2 - 4(7)(-20) = 569$
real, irrational, unequal
$\frac{-(-3) \pm \sqrt{569}}{2(7)} = \frac{3 \pm \sqrt{569}}{14}$

13B

1) $2R^2 + 5R - 3 = 0$
$5^2 - 4(2)(-3) = 49$
real, rational, unequal
$(2R - 1)(R + 3) = 0$
$2R - 1 = 0 \quad R + 3 = 0$
$R = 1/2 \quad R = -3$

2) $X^2 + 8X + 16 = 0$
$8^2 - 4(1)(16) = 0$
real, rational, equal (double roots)
$(X + 4)(X + 4) = 0$
$X = -4$

3) $6Y^2 + 7Y + 11 = 0$
$7^2 - 4(6)(11) = -215$
imaginary
$\frac{-7 \pm \sqrt{-215}}{2(6)} = \frac{-7 \pm i\sqrt{215}}{12}$

4) $4X^2 + 5X + 1 = 0$
$5^2 - 4(4)(1) = 9$
real, rational, unequal
$(4X + 1)(X + 1) = 0$
$4X + 1 = 0 \quad X + 1 = 0$
$X = -1/4 \quad X = -1$

5) $(-5)^2 - 4(6)(-3) = 97$
real, irrational, unequal
$\frac{-(-5) \pm \sqrt{97}}{2(6)} = \frac{5 \pm \sqrt{97}}{12}$