19. $(18i)\left(\sqrt{-36}+7i\right) = (18i)(6i+7i) =$
$(18i)(13i) = 234i^2 = 234(-1) = -234$

20. $\left(i^2\right)\left(i^1\right)\left(i^3\right) = i^{2+1+3} = i^6 = (-1)^3 = -1$

Lesson Practice 12A

1. $X = \dfrac{-(6) \pm \sqrt{(6)^2 - 4(1)(2)}}{2(1)} = \dfrac{-6 \pm \sqrt{28}}{2} =$
$\dfrac{-6 \pm 2\sqrt{7}}{2} = -3 \pm \sqrt{7}$

2. $X^2 - 5X + 4 = 0$
$(X-4)(X-1) = 0$
$X - 4 = 0 \qquad X - 1 = 0$
$X = 4 \qquad X = 1$

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

4. $A^2 - 10A - 11 = 0$
$(A-11)(A+1) = 0$
$A - 11 = 0 \qquad A + 1 = 0$
$A = 11 \qquad A = -1$

5. $2Q^2 + 2 = 17Q$
$2Q^2 - 17Q + 2 = 0$
$\dfrac{-(-17) \pm \sqrt{(-17)^2 - 4(2)(2)}}{2(2)} = \dfrac{17 \pm \sqrt{273}}{4}$

6. $5X^2 + 15X + 10 = 0$
$(5)(X+1)(X+2) = 0$
$X + 1 = 0 \qquad X + 2 = 0$
$X = -1 \qquad X = -2$

7. $\dfrac{1}{4}R^2 - \dfrac{1}{2}R + \dfrac{3}{2} = 0$
$(4)\dfrac{1}{4}R^2 - (4)\dfrac{1}{2}R + (4)\dfrac{3}{2} = (4)0$
$R^2 - 2R + 6 = 0$
$\dfrac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(6)}}{2(1)} =$
$\dfrac{2 \pm \sqrt{-20}}{2} = \dfrac{2 \pm 2i\sqrt{5}}{2} = 1 \pm i\sqrt{5}$

8. $16X^2 = 2X + 4$
$8X^2 = X + 2$
$8X^2 - X - 2 = 0$
$X = \dfrac{-(-1) \pm \sqrt{(-1)^2 - 4(8)(-2)}}{2(8)} = \dfrac{1 \pm \sqrt{65}}{16}$

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

10. $Y^2 = \dfrac{3}{4}Y + 2$
$(4)Y^2 = (4)\dfrac{3}{4}Y + (4)2$
$4Y^2 = 3Y + 8$
$4Y^2 - 3Y - 8 = 0$
$X = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(-8)}}{2(4)} = \dfrac{3 \pm \sqrt{137}}{8}$

Lesson Practice 12B

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

2. $7 = 2X^2 + X$
$0 = 2X^2 + X - 7$
$X = \dfrac{-(1) \pm \sqrt{(1)^2 - 4(2)(-7)}}{2(2)} = \dfrac{-1 \pm \sqrt{57}}{4}$

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

4. $2 + 3X + 4X^2 = 0$
$4X^2 + 3X + 2 = 0$
$X = \dfrac{-(3) \pm \sqrt{(3)^2 - 4(4)(2)}}{2(4)} =$
$\dfrac{-3 \pm \sqrt{-23}}{8} = \dfrac{-3 \pm i\sqrt{23}}{8}$

5. $P = P^2 - 2$
$0 = P^2 - P - 2$
$0 = (P-2)(P+1)$
$P - 2 = 0 \qquad P + 1 = 0$
$P = 2 \qquad P = -1$

6. $X^2 + \frac{1}{5}X + 5 = 0$

$(5)X^2 + (5)\frac{1}{5}X + (5)5 = (5)0$

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

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

7. $20X^2 + 40X = 30$

$2X^2 + 4X = 3$

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

$X = \frac{-(4) \pm \sqrt{(4)^2 - 4(2)(-3)}}{2(2)} = \frac{-4 \pm \sqrt{40}}{4} = \frac{-4 \pm 2\sqrt{10}}{4} = \frac{-2 \pm \sqrt{10}}{2}$

8. $X = \frac{-(2) \pm \sqrt{(2)^2 - 4(5)(-1)}}{2(5)} = \frac{-2 \pm \sqrt{24}}{10} = \frac{-2 \pm 2\sqrt{6}}{10} = \frac{-1 \pm \sqrt{6}}{5}$

9. $3X^2 = -5X$

$3X^2 + 5X = 0$

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

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

$3X = -5$

$X = -\frac{5}{3}$

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

Systematic Review 12C

1. $X^2 - 5X + 6 = 0$

$(X - 3)(X - 2) = 0$

$X - 3 = 0 \qquad X - 2 = 0$

$X = 3 \qquad X = 2$

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

3. $X^2 - 3X + 1 = -6X$

$X^2 + 3X + 1 = 0$

$X = \frac{-(3) \pm \sqrt{(3)^2 - 4(1)(1)}}{2(1)} = \frac{-3 \pm \sqrt{5}}{2}$

4. $X^2 + 4X - 12 = 0$

$(X + 6)(X - 2) = 0$

$X + 6 = 0 \qquad X - 2 = 0$

$X = -6 \qquad X = 2$

5. $X = \frac{-(2) \pm \sqrt{(2)^2 - 4(2)(5)}}{2(2)} = \frac{-2 \pm \sqrt{-36}}{4} = \frac{-2 \pm 6i}{4} = \frac{-1 \pm 3i}{2}$

6. $X^2 + 8X = -16$

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

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

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

7. 169

8. $2X^2 + 9X + \_\_$

divide through by 2:

$X^2 + \frac{9}{2}X + \_\_$

complete the square:

$X^2 + \frac{9}{2}X + \frac{81}{16}$

multiply through by 2:

$2X^2 + 9X + \frac{81}{8}$

9. 40X

10. $2\sqrt{14}X$

11. $X^2+\frac{1}{3}X-\frac{4}{3}=0$

$X^2+\frac{1}{3}X+\frac{1}{36}=\frac{4}{3}+\frac{1}{36}$

$\left(X+\frac{1}{6}\right)^2=\frac{4(12)}{3(12)}+\frac{1}{36}$

$\left(X+\frac{1}{6}\right)^2=\frac{49}{36}$

$X+\frac{1}{6}=\sqrt{\frac{49}{36}}$

$X=-\frac{1}{6}\pm\frac{7}{6}$

$X=-\frac{1}{6}+\frac{7}{6}$ $\qquad$ $X=-\frac{1}{6}-\frac{7}{6}$

$X=\frac{6}{6}=1$ $\qquad$ $X=-\frac{8}{6}=-\frac{4}{3}$

12. $(1)^2+\frac{1}{3}(1)-\frac{4}{3}=0$

$1+\frac{1}{3}-\frac{4}{3}=0$

$\frac{3}{3}+\frac{1}{3}-\frac{4}{3}=0$

$0=0$

$\left(-\frac{4}{3}\right)^2+\frac{1}{3}\left(-\frac{4}{3}\right)-\frac{4}{3}=0$

$\frac{16}{9}-\frac{4}{9}-\frac{12}{9}=0$

$0=0$

13. $(X-A)^6=1X^6(-A)^0+6X^5(-A)^1+$
$15X^4(-A)^2+20X^3(-A)^3+15X^2(-A)^4+$
$6X^1(-A)^5+1X^0(-A)^6=$
$X^6-6X^5A+15X^4A^2-20X^3A^3+$
$15X^2A^4-6XA^5+A^6$

14. $\frac{4}{1}\left(\frac{1}{2}X\right)^3(-3A)^1=4\left(\frac{1}{8}\right)X^3(-3A)=-\frac{3}{2}X^3A$

15. $(5-2A)^3=$
$1(5)^3(-2A)^0+3(5)^2(-2A)^1+$
$3(5)^1(-2A)^2+1(5)^0(-2A)^3=$
$125-150A+60A^2-8A^3$

16. $(X-2Y)$

17. $\frac{6+5i}{3i-2}=\frac{(6+5i)(3i+2)}{(3i-2)(3i+2)}=$
$\frac{18i+12+15i^2+10i}{9i^2-4}=\frac{28i+12+15(-1)}{9(-1)-4}=$
$\frac{28i+12-15}{-9-4}=\frac{28i-3}{-13}$

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

19. $\frac{2}{3-\sqrt{7}}=\frac{2\left(3+\sqrt{7}\right)}{\left(3-\sqrt{7}\right)\left(3+\sqrt{7}\right)}=$
$\frac{6+2\sqrt{7}}{9-7}=\frac{6+2\sqrt{7}}{2}=\frac{3+\sqrt{7}}{1}=3+\sqrt{7}$

20. $\frac{2+\sqrt{5}}{2\sqrt{5}-4}=\frac{\left(2+\sqrt{5}\right)\left(2\sqrt{5}+4\right)}{\left(2\sqrt{5}-4\right)\left(2\sqrt{5}+4\right)}=$
$\frac{4\sqrt{5}+8+4\sqrt{5}+2\sqrt{25}}{4(5)-16}=\frac{8\sqrt{5}+8+2(5)}{20-16}=$
$\frac{8\sqrt{5}+8+10}{4}=\frac{8\sqrt{5}+18}{4}=\frac{4\sqrt{5}+9}{2}$

Systematic Review 12D

1. $X=\frac{-(-9)\pm\sqrt{(-9)^2-4(2)(-7)}}{2(2)}=\frac{9\pm\sqrt{137}}{4}$

2. $X=\frac{-(5)\pm\sqrt{(5)^2-4(1)(-2)}}{2(1)}=\frac{-5\pm\sqrt{33}}{2}$

3. $3X^2+7X+4=0$
$(3X+4)(X+1)=0$

$3X+4=0$ $\qquad$ $X+1=0$

$3X=-4$ $\qquad$ $X=-1$

$X=-\frac{4}{3}$

4. $X=\frac{-(-6)\pm\sqrt{(-6)^2-4(1)(12)}}{2(1)}=$
$\frac{6\pm\sqrt{-12}}{2}=\frac{6\pm2i\sqrt{3}}{2}=3\pm i\sqrt{3}$

5. $5X^2 - 3X - 2 = 0$

$(5X + 2)(X - 1) = 0$

$5X + 2 = 0 \qquad X - 1 = 0$

$5X = -2 \qquad X = 1$

$X = -\frac{2}{5}$

6. $4X^2 + 1 = 4X$

$4X^2 - 4X + 1 = 0$

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

$2X - 1 = 0$

$2X = 1$

$X = \frac{1}{2}$

7. $\frac{25}{4}$

8. $\frac{1}{16}$

9. $25X^2 + \_\_\_ + 1$

divide through by 25:

$X^2 + \_\_\_ + \frac{1}{25}$

complete the square:

$X^2 + \underline{\frac{2}{5}X} + \frac{1}{25}$

multiply through by 25:

$25X^2 + \underline{10X} + 1$

10. $49X^2 - \_\_\_ + 4$

divide through by 49:

$X^2 - \_\_\_ + \frac{4}{49}$

complete the square:

$X^2 - \underline{\frac{4}{7}X} + \frac{4}{49}$

multiply through by 49:

$49X^2 - \underline{28X} + 4$

11. $X^2 - 12X + 20 = 0$

$(X - 10)(X - 2) = 0$

$X - 10 = 0 \qquad X - 2 = 0$

$X = 10 \qquad X = 2$

12. $(10)^2 - 12(10) + 20 = 0$

$100 - 120 + 20 = 0$

$0 = 0$

$(2)^2 - 12(2) + 20 = 0$

$4 - 24 + 20 = 0$

$0 = 0$

13. $(X + 1)^4 =$

$1X^4 1^0 + 4X^3 1^1 + 6X^2 1^2 + 4X^1 1^3 + 1X^0 1^4 =$

$X^4 + 4X^3 + 6X^2 + 4X + 1$

14. $\frac{4 \cdot 3 \cdot 2 \cdot 1}{1 \cdot 2 \cdot 3 \cdot 4}\left(\frac{1}{2}X\right)^0 (-3A)^4 = 81A^4$

15. $\left(10 - \frac{1}{X}\right)^3 = 1(10)^3\left(-\frac{1}{X}\right)^0 +$

$3(10)^2\left(-\frac{1}{X}\right)^1 + 3(10)^1\left(-\frac{1}{X}\right)^2 + 1(10)^0\left(-\frac{1}{X}\right)^3 =$

$1{,}000 - \frac{300}{X} + \frac{30}{X^2} - \frac{1}{X^3}$

16. $(X + 2)$

17. $\frac{4 - 3i}{2i} = \frac{(4 - 3i)(i)}{2i(i)} = \frac{4i - 3i^2}{2i^2} =$

$\frac{4i - 3(-1)}{2(-1)} = \frac{4i + 3}{-2}$

18. $\frac{10 + \sqrt{-A}}{10 - \sqrt{-A}} = \frac{\left(10 + \sqrt{-A}\right)\left(10 + \sqrt{-A}\right)}{\left(10 - \sqrt{-A}\right)\left(10 + \sqrt{-A}\right)} =$

$\frac{100 + 20\sqrt{-A} - A}{100 - (-A)} = \frac{100 + 20i\sqrt{A} - A}{100 + A}$

19. $\frac{9}{7 + \sqrt{10}} = \frac{9\left(7 - \sqrt{10}\right)}{\left(7 + \sqrt{10}\right)\left(7 - \sqrt{10}\right)} =$

$\frac{63 - 9\sqrt{10}}{49 - 10} = \frac{63 - 9\sqrt{10}}{39} = \frac{21 - 3\sqrt{10}}{13}$

20. $\frac{4 - \sqrt{6}}{3\sqrt{7} + 5} = \frac{\left(4 - \sqrt{6}\right)\left(3\sqrt{7} - 5\right)}{\left(3\sqrt{7} + 5\right)\left(3\sqrt{7} - 5\right)} =$

$\frac{12\sqrt{7} - 20 - 3\sqrt{42} + 5\sqrt{6}}{9(7) - 25} =$

$\frac{12\sqrt{7} - 20 - 3\sqrt{42} + 5\sqrt{6}}{63 - 25} =$

$\frac{12\sqrt{7} - 20 - 3\sqrt{42} + 5\sqrt{6}}{38}$

Systematic Review 12E

1. $X^2 + 2X - 8 = 0$

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

$X + 4 = 0 \qquad X - 2 = 0$

$X = -4 \qquad X = 2$

2. $X^2 - 6X = -8$

$X^2 - 6X + 8 = 0$

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

$X - 4 = 0 \qquad X - 2 = 0$

$X = 4 \qquad X = 2$

3. $2X^2 - 15X + 7 = 0$

$(2X - 1)(X - 7) = 0$

$2X - 1 = 0 \qquad X - 7 = 0$

$2X = 1 \qquad X = 7$

$X = \frac{1}{2}$

4. $3X^2 + 4X = 7$

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

$(3X + 7)(X - 1) = 0$

$3X + 7 = 0 \qquad X - 1 = 0$

$3X = -7 \qquad X = 1$

$X = -\frac{7}{3}$

5. $2 = 5X + X^2$

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

$X = \frac{-(5) \pm \sqrt{(5)^2 - 4(1)(-2)}}{2(1)} = \frac{-5 \pm \sqrt{33}}{2}$

6. $X^2 + 2X - 15 = 0$

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

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

$X = -5 \qquad X = 3$

7. $4X^2 + 28X + \_\_\_$

divide through by 4:

$X^2 + 7X + \_\_\_$

complete the square:

$X^2 + 7X + \frac{49}{4}$

multiply through by 4:

$4X^2 + 28X + 49$

8. $9X^2 - 36X + \_\_\_$

divide through by 9:

$X^2 - 4X + \_\_\_$

complete the square:

$X^2 - 4X + \underline{4}$

multiply through by 9:

$9X^2 - 36X + 36$

9. $36X^2 + \_\_\_ + 25$

divide through by 36:

$X^2 + \_\_\_ + \frac{25}{36}$

complete the square:

$X^2 + \frac{10}{6}X + \frac{25}{36}$

multiply through by 36:

$36X^2 + \underline{60X} + 25$

10. $81X^2 - \_\_\_ + 121$

divide through by 81:

$X^2 - \_\_\_ + \frac{121}{81}$

complete the square:

$X^2 - \frac{22}{9}X + \frac{121}{81}$

multiply through by 81:

$81X^2 - \underline{198X} + 121$

11. $X^2 + 5X - 14 = 0$

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

$X + 7 = 0 \qquad X - 2 = 0$

$X = -7 \qquad X = 2$

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

$49 - 35 - 14 = 0$

$0 = 0$

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

$4 + 10 - 14 = 0$

$0 = 0$

13. $(2X + 1)^5 =$

$1(2X)^5 1^0 + 5(2X)^4 1^1 + 10(2X)^3 1^2 +$

$10(2X)^2 1^3 + 5(2X)^1 1^4 + 1(2X)^0 1^5 =$

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

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

15. $\left(X-\frac{3}{5}\right)^3 = 1X^3\left(-\frac{3}{5}\right)^0 + 3X^2\left(-\frac{3}{5}\right)^1 +$
$3X^1\left(-\frac{3}{5}\right)^2 + 1X^0\left(-\frac{3}{5}\right)^3 =$
$X^3 - \frac{9}{5}X^2 + \frac{27}{25}X - \frac{27}{125}$

16. $(2X+1)$

17. $\frac{10+i}{5i} = \frac{(10+i)(i)}{5i(i)} = \frac{10i+i^2}{5i^2} = \frac{10i-1}{-5}$

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

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

20. $\frac{6-\sqrt{2}}{10\sqrt{3}-8} = \frac{\left(6-\sqrt{2}\right)\left(10\sqrt{3}+8\right)}{\left(10\sqrt{3}-8\right)\left(10\sqrt{3}+8\right)} =$
$\frac{60\sqrt{3}+48-10\sqrt{6}-8\sqrt{2}}{100(3)-64} =$
$\frac{2\left(30\sqrt{3}+24-5\sqrt{6}-4\sqrt{2}\right)}{300-64} =$
$\frac{2\left(30\sqrt{3}+24-5\sqrt{6}-4\sqrt{2}\right)}{236} =$
$\frac{30\sqrt{3}+24-5\sqrt{6}-4\sqrt{2}}{118}$

Lesson Practice 13A

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

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

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

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

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

Lesson Practice 13B

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

4. $P = \frac{6!}{3!} = \frac{6 \times 5 \times 4 \times \cancel{3 \times 2 \times 1}}{\cancel{3 \times 2 \times 1}} =$

$6 \times 5 \times 4 = 120$

5. $P = \frac{6!}{2!} = \frac{6 \times 5 \times 4 \times 3 \times \cancel{2 \times 1}}{\cancel{2 \times 1}} =$

$6 \times 5 \times 4 \times 3 = 360$

6. $P = \frac{6!}{3!2!} =$

$\frac{\overset{3}{\cancel{6}} \times 5 \times 4 \times \cancel{3 \times 2 \times 1}}{\cancel{3 \times 2 \times 1} \times \cancel{2 \times 1}} = 5 \times 4 \times 3 = 60$

7. m, a, and t each appear twice

$P = \frac{11!}{2!2!2!} =$

$\frac{11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times \cancel{4} \times 3 \times \cancel{2 \times 1}}{\cancel{2} \times 1 \times \cancel{2} \times 1 \times \cancel{2 \times 1}} =$

$11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 3 = 4{,}989{,}600$

8. $P = \frac{20!}{15!3!2!} = \frac{20 \times 19 \times \overset{3}{\cancel{18}} \times 17 \times \overset{8}{\cancel{16}}}{\cancel{3 \times 2} \times 1 \times \cancel{2} \times 1} =$

$20 \times 19 \times 3 \times 17 \times 8 = 155{,}040$

Honors Lesson 12

1. $\binom{6}{5-1}X^{6-5+1}Y^{5-1} = \binom{6}{4}X^2Y^4$

$\frac{6!}{2!4!}X^2Y^4 = \frac{6 \times 5 \times \cancel{4!}}{2 \times \cancel{4!}} = 15X^2Y^4$

2. $\binom{4}{2-1}A^{4-2+1}2^{2-1} = \binom{4}{1}A^3 2 = 8A^3$

3. $\binom{5}{3-1}P^{5-3+1}Q^{3-1} = \binom{5}{2}P^3Q^2$

$\frac{5!}{3!2!}P^3Q^2 = \frac{5 \times 4 \times \cancel{3!}}{\cancel{3!} \times 2 \times 1} = 10P^3Q^2$

4. $\binom{7}{4-1}(2X)^{7-4+1}\left(-1^{4-}\right) = \binom{7}{3}(2X)^4\left(-1^3\right) =$

$\frac{7!}{4!3!}\left(-16X^4\right) = \frac{7 \times \cancel{6} \times 5 \times \cancel{4!}}{\cancel{4!} \times \cancel{3} \times \cancel{2} \times 1}\left(-16X^4\right)$

$= (35)\left(-16X^4\right) = -560X^4$

Honors Lesson 13

1. $\text{Area} = X(20 - 2X)$

$= 20X - 2X^2$

$48 = 20X - 2X^2$

$24 = 10X - X^2$

$X^2 - 10X + 24 = 0$

$(X - 6)(X - 4) = 0$

$X = 6,\ 4$

If X = 6 feet, then the long side would be:

$20 - 2(6) = 20 - 12 = 8$ ft

If X = 4 feet, then the long side would be:

$20 - 2(4) = 20 - 8 = 12$ ft

2. $\text{Area} = X\left(\frac{160 - 3X}{2}\right)$

$= \frac{160X - 3X^2}{2}$

$1{,}000 = \frac{160X - 3X^2}{2}$

$2000 = 160X - 3X^2$

$3X^2 - 160X + 2{,}000 = 0$

$(X - 20)(3X - 100) = 0$

$X = 20,\ 33\frac{1}{3}$

If X = 20, then the other side would be:

$(160 - 3(20)) \div 2 =$

$(160 - 60) \div 2 =$

$100 \div 2 = 50$ ft

$20 \times 50 = 1{,}000$ ft^2

If $X = 33\frac{1}{3}$, the other side would be:

$\left(160 - 3\left(33\frac{1}{3}\right)\right) \div 2 =$

$(160 - 100) \div 2 =$

$60 \div 2 = 30$ ft

$30 \times 33\frac{1}{3} = 1000$ ft^2