1F

1) $\frac{1}{\frac{1}{4}} = 4$

2) 1

3) $8 \times 9 = 72$

4) 10^4

5) $(11^{10})^3 = 11^{30}$

6) 4

7) $X^5 X^{-7} Y^{-6} Y^3 Y^8 = X^{-2} Y^5$

8) $A^{-2} D^{15} C^{-5}$

9) $-\frac{8}{27}$

10) $-\frac{1}{125}$

11) $\left[\frac{2}{3}X + \frac{1}{4}X - \frac{1}{2} = 0\right] \times 12 =$

$8X + 3X - 6 = 0$
$11X = 6$
$X = 6/11$

12) [1.3 - .6F - .07 = 0] x 100 130 - 60F - 7 = 0
$123 = 60F$
$F = 123/60 = 41/20$

13) $\left[\frac{3}{4} + \frac{1}{3}Q = 1\frac{5}{6}\right] \times 12 =$

$9 + 4Q = 22$
$4Q = 13$
$Q = 13/4 = 3\ 1/4$

14) [.2X - .03 = .97] x 100
$20X = 100$
$X = 5$

15) $27Q(1 - 2X)$

16) $A^2B(1 + A^2B)$

17) $4Y^2 + 10Y - 6$

18) $X^3 Y + X^5$

19) $-16 + 25 - 2 = 7$

20) $6(7) - 40 + 9 \div 2 =$
$42 - 40 + 4\ 1/2 = 6\ 1/2$

2F

1) correct

2) correct

3) $\frac{\cancel{YX}}{\cancel{YX}} + \frac{\cancel{Y^2X}}{\cancel{YX}} = 1 + Y$

4) $\frac{\overset{2}{\cancel{16X^2}}}{\cancel{8X}} - \frac{\overset{3}{\cancel{24X}}}{\cancel{8X}} = 2X + 3$

5) $\frac{\overset{5}{\cancel{25Y}}}{\underset{2}{\cancel{10}}} - \frac{\overset{3}{\cancel{15}}}{\underset{2}{\cancel{10}}} = \frac{5Y}{2} - \frac{3}{2}$

6) $\frac{3(X)}{Y(X)} - \frac{Z(Y)}{X(Y)} = \frac{3X - ZY}{YX}$

7) $\frac{2(X - 1)}{(X + 1)(X - 1)} + \frac{3X(X + 1)}{(X - 1)(X + 1)} = \frac{3X^2 + 5X - 2}{(X + 1)(X - 1)}$

8) $\frac{1(Y)}{2(Y)} - \frac{X(2)}{Y(2)} = \frac{Y - 2X}{2Y}$

9) $\frac{1}{X^3} = X^{-3}$

10) $\frac{1}{(\frac{2}{3})^3} = \frac{1}{\frac{8}{27}} = \frac{27}{8}$

11) $X^{-4} = \frac{1}{X^4}$

12) 2^8

13) $R^6 S^{-9}$ or $\frac{R^6}{S^9}$

14) $(1)P^8 P^{-2} = P^6$

15) [.14 - .023 = .07C] x 1000
$140 - 23 = 70C$
$117 = 70C$
$C = 117/70 = 1\ 47/70$

16) $\left[2\frac{3}{5}D - \frac{3}{8}D = 4\frac{7}{10}\right] 40 =$

$\left[\frac{13}{5}D - \frac{3}{8}D = \frac{47}{10}\right] 40 =$

$104D - 15D = 188$
$89D = 188$
$D = 188/89$

17) $50AC(2B + A)$

18) $49(2C + 4 - A)$

19) $15 - 1 + 225 = X$
$239 = X$

20) $2X + 32 + 9 - 3X + 6 = 4X$
$47 = 5X$
$X = 47/5$

3F

1) 3.2×10^{1}

2) 4.7×10^{-6}

3) 5.8×10^{-4}

4) 2.9×10^{8}

5) $(3.2 \times 10^{1})(2.9 \times 10^{8}) =$
$(3.2 \times 2.9)(10^{1} \times 10^{8}) =$
$(9.28)(10^{9})$

6) $(4.7 \times 10^{-6})(5.8 \times 10^{-4}) =$
$(4.7 \times 5.8)(10^{-6+(-4)}) =$
$(27.26)(10^{-10}) =$
$(2.726 \times 10^{1})(10^{-10}) = 2.726 \times 10^{-9}$

7) $(3.2 \times 10^{1}) \div (2.9 \times 10^{8}) =$
$(3.2 \div 2.9)(10^{1-8}) =$
1.103×10^{-7}

8) $(5.8 \times 10^{-4}) \div (3.2 \times 10^{1}) =$
$(5.8 \div 3.2)(10^{-4-1}) =$
$(1.8125)(10^{-5}) =$
1.8125×10^{-5}

9) $7X^{-1}Y^{-2} - 10XY^{2} - 4XY^{2} = 7X^{-1}Y^{-2} - 14XY^{2}$

10) $8XY^{3} - 6XY^{3} = 2XY^{3}$

11) $2AB^{-2} - A - 4AB^{2}$

12) $5A^{-1}B + 6A^{-1}B^{-1} + 3A^{-1}B =$
$8A^{-1}B + 6A^{-1}B^{-1}$

13) $\frac{\cancel{9AB}^{3}}{\cancel{3AB}} - \frac{\cancel{12A^{2}B^{2}}^{4}}{\cancel{3AB}} = 3 - 4AB$

14) $\frac{10X^{2}}{5X} + \frac{15XY}{5X} + \frac{5Y^{2}}{5X} =$
$2X + 3Y + \frac{Y^{2}}{X}$

15) $\frac{X^{2}(3X)}{Y(3X)} + \frac{Y^{2}(Y)}{3X(Y)} =$
$\frac{3X^{3} + Y^{3}}{3XY}$

16) $\frac{2Q}{9Q} + \frac{4(9)}{Q(9)} = \frac{2Q + 36}{9Q}$

17) $1^{5} = 1$

18) $X^{6}Y^{3}$

19) $-\frac{1}{3X^{3}} - Y^{4} + \frac{6Y^{3}}{X}$

20) $\frac{X^{4}Y}{XY^{3}} + \frac{4X^{3}Y^{3}}{X^{3}Y^{2}} = X^{3}Y^{-2} + 4Y$

4F

1) $\frac{1}{5}(15X^{3}) = 3X^{3}$

2) $-3\sqrt{7}$

3) $30\sqrt{100} = 30(10) = 300$

4) $2\sqrt{132} + 5\sqrt{143} = 2\sqrt{4}\ \sqrt{33} + 5\sqrt{143} =$
$4\sqrt{33} + 5\sqrt{143}$

5) $\sqrt{25} = 5$

6) $\sqrt{3}$

7) $7\sqrt{64}\sqrt{2} = 7(8)\sqrt{2} = 56\sqrt{2}$

8) $\frac{3}{4}\sqrt{4}\sqrt{6} = \frac{3}{4}2\sqrt{6} = \frac{3}{2}\sqrt{6}$

9) $\frac{6\sqrt{2}\ \sqrt{5}}{\sqrt{5}\ \sqrt{5}} = \frac{6\sqrt{10}}{5}$

10) $\frac{1\sqrt{8}}{\sqrt{8}\ \sqrt{8}} + \frac{1\sqrt{10}}{\sqrt{10}\sqrt{10}} = \frac{\sqrt{8}\,(5)}{8\,(5)} + \frac{\sqrt{10}\ (4)}{10\ (4)} =$
$\frac{5\sqrt{8}\ + 4\sqrt{10}}{40} = \frac{5\sqrt{4x2}\ + 4\sqrt{10}}{40} = \frac{5\sqrt{2}\ + 2\sqrt{10}}{20}$

11) $(8.6 \times 10^{-2})(9.3 \times 10^{-1})$
$79.98 \times 10^{-3} =$
$7.998 \times 10^{-2} =$

12) $(5.5 \times 10^{6})(2.3 \times 10^{-3})$
$12.65 \times 10^{3} = 1.265 \times 10^{4}$

13) $(8.5 \times 10^{4}) \div (1.7 \times 10^{-4}) =$
$(8.5 \div 1.7)(10^{4-(-4)})$
5×10^{8}

14) $\frac{(\cancel{32}^{8} \times 10^{7})(\cancel{22}^{1} \times 10^{-10})}{(\cancel{88}^{\cancel{4}\,1} \times 10^{-8})} =$
$\frac{(8 \times 10^{7})(1 \times 10^{-10})}{(1 \times 10^{-8})} =$
$\frac{8 \times 10^{-3}}{1 \times 10^{-8}} = 8 \times 10^{5}$

15) $7D^{2}EF^{-1} - 4D^{2}F^{-1} - 8DF^{-1}E$

16) $\left[\frac{X + 6}{X} - \frac{X - 6}{X} = 6\right]X$
$X + 6 - (X - 6) = 6X$
$X + 6 - X + 6 = 6X$
$12 = 6X$
$2 = X$

17) $-60A^{4}B^{4}$

18) $7X^{4}Y^{2}Z^{-1}$

19) $\left[\frac{6X}{5} - \frac{2X}{3} = X - 10\right]15$
$18X - 10X = 15X - 150$
$8X = 15X - 150$
$150 = 7X$
$21\ 3/7 = X$

20) $\left[\frac{5X - 1}{2} = \frac{4X + 5}{3} + \frac{X + 2}{6}\right]6$
$15X - 3 = 8X + 10 + X + 2$
$15X - 3 = 9X + 12$
$6X = 15$
$X = 2\ 1/2$

Solutions 3F and 4F

5F

1) $(X - 6)(X - 3)$

2) $(X + 8)(X + 3)$

3) $(X - 4)(X - 3)$

4) $(2X + 7)(X + 5)$

5) $(5X - 6)(5X + 6)$

6) $(X - 13)(X + 13)$

7) $(2X - 1)(X + 3)$

8) $(4X + 1)(X + 2)$

9) $2X^2 - 98 = 0$
$2(X^2 - 49) = 0$
$2(X - 7)(X + 7) = 0$
$X = 7, -7$

$2(7)^2 - 98 = 0$
$98 - 98 = 0$ ✓

$2(-7)^2 - 98 = 0$
$98 - 98 = 0$ ✓

10) $X^2 - 9/4X = 0$
$X(X - 9/4) = 0$
$X = 0 \quad X = 9/4$

$(0)^2 - 9/4(0) = 0$
$0 = 0$ ✓

$(9/4)^2 - 9/4(9/4) = 0$
$81/8 - 81/8 = 0$ ✓

11) $\dfrac{1(2Y)}{X(2Y)} - \dfrac{1(2X)}{Y(2X)} + \dfrac{1(X)}{2Y(X)} =$

$\dfrac{2Y - 2X + X}{2XY} = \dfrac{2Y - X}{2XY}$

12) $\dfrac{X + 5}{X^2 - 16} + \dfrac{(3 - X)(-1)}{(4 - X)(-1)} = \dfrac{X + 5}{X^2 - 16} + \dfrac{(X - 3)(X + 4)}{(X - 4)(X + 4)} =$

$\dfrac{(X + 5) + (X^2 + X - 12)}{X^2 - 16} = \dfrac{X^2 + 2X - 7}{X^2 - 16}$

13) $\dfrac{\frac{1}{4} - 2}{\frac{3}{5} - 1} = \dfrac{\frac{-7}{4} \cdot \frac{-5}{2}}{\frac{-2}{5} \cdot \frac{-5}{2}} = \dfrac{35}{8}$

14) $\dfrac{\frac{A}{B} + \frac{A(B)}{(B)}}{\frac{2(A)}{B(A)} + \frac{3(B)}{A(B)}} = \dfrac{\frac{A + AB}{B} \cdot \frac{AB}{2A + 3B}}{\frac{2A + 3B}{AB} \cdot \frac{AB}{2A + 3B}}$

$\dfrac{A^2 + A^2B}{2A + 3B}$

15) $\dfrac{4\sqrt{42}}{\sqrt{7}} = 4\sqrt{6}$

16) $9\sqrt{25}\ \sqrt{5} = 9(5)\sqrt{5} = 45\sqrt{5}$

17) $\dfrac{27\sqrt{13}}{\sqrt{13}\sqrt{13}} = \dfrac{27\sqrt{13}}{13}$

18) $\dfrac{7\sqrt{13}}{\sqrt{13}\ \sqrt{13}} + \dfrac{8\sqrt{14}}{\sqrt{14}\ \sqrt{14}} =$

$\dfrac{7\sqrt{13}\ (7)}{13\ (7)} + \dfrac{8\sqrt{14}\ (13)}{14\ (13)} =$

$\dfrac{49\sqrt{13} + 52\sqrt{14}}{91}$

19) $\dfrac{(18 \times 10^1)(63 \times 10^{-3})}{(2 \times 10^4)(81 \times 10^{-5})} =$

$\dfrac{7 \times 10^{-2}}{1 \times 10^{-1}} = 7 \times 10^{-1}$

20) $\dfrac{X(X + 5)}{(X - 5)(X + 5)} = \dfrac{X}{X - 5}$

6F

1) $(2)^{-5} = \dfrac{1}{32}$

2) $\dfrac{1 \cdot \frac{7}{5}}{\frac{5}{7} \cdot \frac{7}{5}} = \dfrac{7}{5}$

3) $X^{-3/4}$

4) $(\dfrac{2}{3})^3 = \dfrac{8}{27}$

5) $[\,(X^6)^{1/3}]^{1/2} = (X^6)^{1/6} = X$

6) $[\,(81)^{1/4}\,]^{-1} = 3^{-1} = \dfrac{1}{3}$

7) $[\,(10{,}000)^{1/2}\,]^{1/2} = 10$

8) $[(64)^{1/6}]^{-2} = 2^{-2} = \dfrac{1}{4}$ or $\dfrac{1}{2^2}$

9) $(X + 7)(X + 7)$

10) $(4X - 1)(4X - 1)$

11) $(X + 4)(X - 1)$

12) $(2X + 1)(2X + 1)$

13) $X^2 + 5X - 24 = 0$
$(X + 8)(X - 3) = 0$
$X = -8, 3$

$(-8)^2 + 5(-8) - 24 = 0$
$64 - 40 - 24 = 0$ ✓

$(3)^2 + 5(3) - 24 = 0$
$9 + 15 - 24 = 0$ ✓

14) $X^2 - 7X + 12 = 0$
$(X - 4)(X - 3) = 0$
$X = 4, 3$

$(4)^2 - 7(4) + 12 = 0$
$16 - 28 + 12 = 0$ ✓

$(3)^2 - 7(3) + 12 = 0$
$9 - 21 + 12 = 0$ ✓

15) $\dfrac{(X - 8)\ \ 4}{(X - 8)(X - 2)} - \dfrac{5\ \ (X - 2)}{(X - 8)(X - 2)} =$

$\dfrac{4X - 32 - 5X + 10}{X^2 - 10X + 16} =$

$\dfrac{-X - 22}{X^2 - 10X + 16} =$

16) $\dfrac{(X+ 4)(X + 1)}{(X + 4)(X + 3)} - \dfrac{2X - 5}{X^2 + 7X + 12} + \dfrac{(X + 2)(X + 3)}{(X + 4)(X + 3)} =$

$\dfrac{X^2 + 5X + 4 - 2X + 5 + X^2 + 5X + 6}{X^2 + 7X + 12} =$

$\dfrac{2X^2 + 8X + 15}{X^2 + 7X + 12}$

17) $\dfrac{\frac{(7)X}{(7)5} - \frac{4(5)}{7(5)}}{\frac{2X}{5} + \frac{X(5)}{(5)}} = \dfrac{\frac{7X - 20}{7\,35} \cdot \frac{5}{7X}}{\frac{7X}{5} \cdot \frac{5}{7X}} =$

$\dfrac{7X - 20}{49X}$

18) $\dfrac{(X + 2)(X - 2)}{(X - 6)(X + 6)} \cdot \dfrac{6(X - 6)}{X^2(X - 2)} =$

$\dfrac{6(X + 2)}{X^2(X + 6)}$

19) $\dfrac{4}{3}$

20) $\dfrac{3\sqrt{5}}{\sqrt{3}\ \sqrt{12}} - \dfrac{9\sqrt{6}}{\sqrt{6}\ \sqrt{6}} = \dfrac{5\sqrt{3}}{6} - \dfrac{9\sqrt{6}}{6} =$

$\dfrac{5\sqrt{3} - 9\sqrt{6}}{6}$

7F

1) 5

2) $10i$

3) $4Xi$

4) $\frac{10}{12}\,i = \frac{5}{6}\,i$

5) $13i + 15i = 28i$

6) $8 + \sqrt{4}\,\sqrt{11}\,\sqrt{-1} = 8 + 2i\sqrt{11}$

7) $\sqrt{25}\,\sqrt{2} + 2\sqrt{25}\,\sqrt{5}\,\sqrt{-1} =$
$5\sqrt{2} + 10i\sqrt{5}$

8) $-126i^2 = -126(-1) = 126$

9) $i^4 = i^2 \cdot i^2 = (-1)(-1) = 1$

10) $[8(10i)][9(2i)] = (80i)(18i) = 1{,}440i^2 = -1{,}440$

11) $(16)(8) = 128$ or $(2^4)(2^3) = 2^7$

12) $(X^4)(X^0) = X^4(1) = X^4$

13) $[(16)^{1/2}]^{3/2} = 16^{3/4} = 8$

14) $[(343)^{1/3}]^{1/2} = 7^{1/2}$ or $\sqrt{7}$

15) $[X^2 = 5/2X - 3/2] \times 2$
$2X^2 = 5X - 3$
$2X^2 - 5X + 3 = 0$
$(2X - 3)(X - 1) = 0$
$X = 3/2 \quad X = 1$

$2(3/2)^2 - 5(3/2) + 3 = 0$
$9/2 - 15/2 + 6/2 = 0$ ✓
$2(1)^2 - 5(1) + 3 = 0$
$2 - 5 + 3 = 0$ ✓

16) $25X^2 - 9 = 0$
$(5X - 3)(5X + 3) = 0$
$X = 3/5 \quad X = -3/5$

$25(3/5)^2 - 9 = 0$
$9 - 9 = 0$ ✓

$25(-3/5)^2 - 9 = 0$
$9 - 9 = 0$ ✓

17) $\frac{5X^2 + 20X - 105}{14X - 70} \div \frac{X^2 + 7X}{3X - 15} =$

$\frac{5(X+7)(X-3)}{14(X-5)} \cdot \frac{3(X-5)}{X(X+7)} =$

$\frac{15X - 45}{14X}$

18) $\sqrt{\frac{1}{8}}\left(\sqrt{\frac{4}{5}} = \frac{\sqrt{1}}{\sqrt{8}}\right)\left(\frac{\sqrt{4}}{\sqrt{5}} =\right.$

$\frac{1\sqrt{2}}{\sqrt{8}\sqrt{2}}\left(\frac{2\sqrt{5}}{\sqrt{5}\sqrt{5}} =\right.$

$\frac{\sqrt{2}(5)}{4(5)}\left(\frac{2\sqrt{5}(4)}{5(4)} = \frac{5\sqrt{2}\,(\,8\sqrt{5}}{20}\right.$

19) $(1.2 \times 10^7)(1.3 \times 10^3)(5 \times 10^{-6}) =$
7.8×10^4

20) $\frac{7AX^2}{Y} - \frac{3A}{Y} + \frac{8AX^2}{Y} = \frac{-3A}{Y} + \frac{15AX^2}{Y}$

8F

1) $8i - 5$

2) $5 + 2\sqrt{10}$

3) $X^2 - Y^2i^2 = X^2 + Y^2$

4) $3X^2 - 1/4$

5) $(5X - 1)(5X + 1)$

6) $X = \pm\frac{1}{5}$

7) $(\sqrt{3}\,X - 5)(\sqrt{3}\,X + 5)$

8) $X = \pm\frac{5\sqrt{3}}{\sqrt{3}\sqrt{3}}$

$X = \pm\frac{5\sqrt{3}}{3}$

9) $3\sqrt{(\,1}\sqrt{4}\sqrt{6} + 4\sqrt{(\,1}\sqrt{25}\sqrt{6}$
$6i\sqrt{6} + 20i\sqrt{6} = 26i\sqrt{6}$

10) $(-6i)(2 \cdot 10i) = -120i^2 = 120$

11) $\sqrt{(\,1}\sqrt{4}\sqrt{2}\,\sqrt{}\,i\sqrt{2} = 2i\sqrt{2}\,\sqrt{}\,i\sqrt{2} = 2$

12) $i^3 = i^2 \cdot i = -i$

13) $(13^2)^{1/2} = 13$

14) $(25)^{-3/2} = \frac{1}{25^{3/2}} = \frac{1}{125}$

15) $6X^2 + X - 12$
$(2X + 3)(3X - 4) = 0$
$X = -3/2 \quad X = 4/3$

$6(-3/2)^2 + (-3/2) - 12 = 0$
$27/2 - 3/2 - 24/2 = 0$ ✓

$6(4/3)^2 + (4/3) - 12 = 0$
$32/3 + 4/3 - 36/3 = 0$ ✓

16) $6X^2 + 5X - 6 = 0$
$(2X + 3)(3X - 2) = 0$
$X = -3/2 \quad X = 2/3$

$6(-3/2)^2 + 5(-3/2) - 6 = 0$
$27/2 - 15/2 - 12/2 = 0$ ✓

$6(2/3)^2 + 5(2/3) - 6 = 0$
$8/3 + 10/3 - 18/3 = 0$ ✓

17) $\frac{X^2 + 8X + 15}{X^2 - X - 2} \div \frac{-4X - 20}{X^2 + 8X + 7} =$

$\frac{(X+3)(X+5)}{(X-2)(X+1)} \cdot \frac{(X+7)(X+1)}{-4(X+5)} =$

$\frac{X^2 + 10X + 21}{-4X + 8}$

18) $2\sqrt{\frac{1}{4X}}\,\frac{\sqrt{X}}{\sqrt{X}} + 3\,\sqrt{\frac{8}{X}}\,\frac{\sqrt{X}}{\sqrt{X}} =$

$\frac{2\sqrt{X}}{2X} + \frac{3\sqrt{8X}}{X} = \frac{\sqrt{X} + 6\sqrt{2X}}{X}$

19) $(-3X^5Y^{-3})^2 = 9X^{10}Y^{-6}$

20) $\frac{\frac{6X^2}{X} + \frac{9}{X}}{\frac{5X^2 + 7X}{X} + \frac{3}{X}} = \frac{6X^2 + 9}{X} \cdot \frac{X}{5X^2 + 7X + 3}$

$\frac{X}{5X^2 + 7X + 3} \cdot \frac{X}{5X^2 + 7X + 3}$

$\frac{6X^2 + 9}{5X^2 + 7X + 3}$

Solutions 7F and 8F

9F

1) $X^2 + 20X + 100$

2) $25X^2 - 10X + 1$

3) $(X - 6)^2$

4) $(2X - 3)^2$

5) $X^3 + 3X^2(1/4) + 3X(1/4)^2 + (1/4)^3$
$X^3 + 3/4\ X^2 + 3/16\ X + 1/64$

6) $X^3 - 3X^2(5) + 3X(5)^2 - 5^3$
$X^3 - 15X^2 + 75X - 125$

7) $(4X)^3 + 3(4X)^2(1) + 3(4X)1^2 + 1^3$
$64X^3 + 48X^2 + 12X + 1$

8) $X^3 + 3X^2(10) + 3X(10)^2 + 10^3$
$X^3 + 30X^2 + 300X + 1{,}000$

9) $7 - 3i\sqrt{10}$

10) $(2X - 2/5)(2X + 2/5)$

11) $\dfrac{6\sqrt{A}(\sqrt{X}\,(\,2)}{(\sqrt{X}+2)(\sqrt{X}\,(\,2)} = \dfrac{6\sqrt{AX}\,(\,12\sqrt{A}}{X\,(\,4}$

12) $\dfrac{3\quad(9 - 8i)}{(9 + 8i)(9 - 8i)} = \dfrac{-27 + 24i}{81 - 64i^2} = \dfrac{-27 + 24i}{145}$

13) $(-5)(\sqrt{-1}\,\sqrt{100}\,\sqrt{3}\ =$
$(-5i)(10\sqrt{3}\,)$
$-50i\sqrt{3}$

14) $10i^2 = -10$

15) $(10{,}000)^{1/2} = 100$

16) $(X^{1/2})^6 = X^{6/2} = X^3$

17) $7X^2 - 4X = 0$
$X(7X - 4) = 0$
$X = 0,\ 4/7$

$7(0)^2 - 4(0) = 0$
$0 = 0$ ✓
$7(4/7)^2 - 4(4/7) = 0$
$16/7 - 16/7 = 0$ ✓

18) $\dfrac{\overset{2}{\cancel{20}}X^3\cancel{Y}}{\cancel{X^6}\cancel{Y}} \cdot \dfrac{\cancel{5X^2}}{\underset{4}{\cancel{20}}XY^2} = \dfrac{2X^4}{Y^2}$

19) $X^2\sqrt{\dfrac{6}{2X}} + 4\sqrt{\dfrac{5}{X^2}}$

$\dfrac{X^2\sqrt{6}\,\sqrt{2X}}{\sqrt{2X}\,\sqrt{2X}} + \dfrac{4\sqrt{5}}{X} =$

$\dfrac{2X^2\sqrt{3X}}{2X} + \dfrac{4\sqrt{5}}{X} =$

$\dfrac{X^2\sqrt{3X} + 4\sqrt{5}}{X}$

20) $\dfrac{\dfrac{(X - 2)1}{(X - 2)} - \dfrac{3X}{X - 22}}{\dfrac{3}{X^2 - 4}} = \dfrac{\dfrac{X - 2 - 3X}{X - 2}}{\dfrac{3}{X^2 - 4}} =$

$\dfrac{\dfrac{-2 - 2X}{\cancel{X - 2}} \cdot \dfrac{\overset{X+2}{\cancel{X^2 - 4}}}{3}}{\dfrac{\cancel{3}}{\cancel{X^2 - 4}} \cdot \dfrac{\cancel{X^2 - 4}}{\cancel{3}}} =$

$\dfrac{(-2 - 2X)(X + 2)}{3} = \dfrac{-2(X + 1)(X + 2)}{3}$

10F

1) 5

2) $(2X)^4 + 4(2X)^3(-3) + 6(2X)^2(-3)^2 + 4(2X)(-3)^3 + (-3)^4$
$16X^4 - 96X^3 + 216X^2 - 216X + 81$

3) 7

4) $X^6 + 6X^5 4 + 15X^4 4^2 + 20X^3 4^3 + 15X^2 4^4 + 6X\ 4^5 + 4^6$
$X^6 + 24X^5 + 240X^4 + 1280X^3 + 3840X^2 + 6144X + 4096$

5) $\dfrac{4 \cdot 3}{1 \cdot 2}\ X^2 4^2 = (6)(X^2)(16) = 96X^2$

6) $\dfrac{4 \cdot \cancel{3} \cdot \cancel{2}}{1 \cdot \cancel{2} \cdot \cancel{3}}\ X\ 4^3 = (4)(X)(64) = 256X$

7) $\dfrac{6}{1}\ (2X)^5(-1)^1 = (-6)(32X^5) = -192X^5$

8) $\dfrac{\overset{3}{\cancel{6}} \cdot 5 \cdot \cancel{4} \cdot \cancel{3}}{1 \cdot \cancel{2} \cdot \cancel{3} \cdot \cancel{4}}\ (2X)^2(-1)^4 = (15)(4X)^2 = 60X^2$

9) $9X^2 + 12AX + 4A^2$

10) $(2X - 1/3)^2$

11) $(2X)^3 + 3(2X)^2\,(7) + 3(2X)(7)^2 + 7^3$
$8X^3 + 84X^2 + 294X + 343$

12) $X^3 + 3X^2(-1/10) + 3X(-1/10)^2 + (-1/10)^3$
$X^3 - 3/10\ X^2 + 3/100\ X - 1/1000$

13) $\dfrac{(7\sqrt{2}\,)(8\sqrt{5} + 7)}{(8\sqrt{5} - 7)(8\sqrt{5} + 7)} =$

$\dfrac{56\sqrt{10} + 49\sqrt{2}}{64 \cdot 5 - 49} =$

$\dfrac{56\sqrt{10} + 49\sqrt{2}}{271}$

14) $\dfrac{10i\ (6 + 12i)}{(6 - 12i)(6 + 12i)} = \dfrac{60i + 120i^2}{36 - 144i^2} =$

$\dfrac{60i - 120}{180} = \dfrac{i - 2}{3}$

15) $-225i^2 = 225$

16) $88i\sqrt{(\,49} = 88i(7)i = 616i^2 = -616$

17) $14\sqrt{\dfrac{2}{25}} + 5\sqrt{192} =$

$\dfrac{14\sqrt{2}}{\sqrt{25}} + \dfrac{5\sqrt{64}\,\sqrt{3}}{1} =$

$\dfrac{14\sqrt{2}}{5} + \dfrac{40\sqrt{3}\,(5)}{1\,(5)} = \dfrac{14\sqrt{2} + 200\sqrt{3}}{5}$

18) $[(10^4)^{1/2}]^{5/2} = [10^2]^{5/2} = 10^5$

19) $\dfrac{2\cancel{(X + 1)}\cancel{(X + 1)}}{\cancel{(X + 1)}(X - 1)} \cdot \dfrac{1}{\underset{3}{\cancel{6}}X\cancel{(X + 1)}} =$

$\dfrac{1}{3X^2 - 3X}$

20) $64A^2X^2 + \dfrac{Y^2}{A^2} - \dfrac{A^2Y^2}{4}$

11F

1) $1/9\ X^2 + 2/21\ X + 1/49$

2) $4X^2 + 52X + 169$

3) 144

4) 1/4

5) 1/2 X

6) 30X

7) $X^2 + 10X + 25 = -20 + 25$
$(X + 5)^2 = 5$
$\sqrt{(X + 5)^2} = \sqrt{5}$
$X + 5 = \pm\sqrt{5}$
$X = -5 \pm \sqrt{5}$

8) $(-5 + \sqrt{5})^2 + 10(-5 + \sqrt{5}) + 20 = 0$
$25 - 10\sqrt{5} + 5 - 50 + 10\sqrt{5} + 20 = 0$
$30 - 50 + 20 = 0$
$(-5 - \sqrt{5})^2 + 10(-5 - \sqrt{5}) + 20 = 0$
$25 + 10\sqrt{5} + 5 - 50 - 10\sqrt{5} + 20 = 0$
$30 - 50 + 20 = 0$

9) $(X - 5)(X - 1) = 0$
$X = 5,\ 1$

10) $(5)^2 - 6(5) + 5 = 0$
$25 - 30 + 5 = 0$
$(1)^2 - 6(1) + 5 = 0$
$1 - 6 + 5 = 0$

11) $X^4 + 4X^3(-2) + 6X^2(-2)^2 + 4X(-2)^3 + (-2)^4 =$
$X^4 - 8X^3 + 24X^2 - 32X + 16$

12) $X^6 + 6X^5 + 15X^4 + 20X^3 + 15X^2 + 6X + 1$

13) X^5

14) $\frac{5 \cdot 4 \cdot 3 \cdot 2}{1 \cdot 2 \cdot 3 \cdot 4}\ X^1(-2/3)^4 = 5X(16/81) =$
$80/81\ X$

15) $X^3 + 3X^2(-1/3) + 3X(-1/3)^2 + (-1/3)^3 =$
$X^3 - X^2 + 1/3\ X - 1/27$

16) $(X - 2)^3$

17) $\frac{(10i\sqrt{10})(6i + 5)}{(6i - 5)(6i + 5)} =$
$\frac{60i^2\sqrt{10} + 50i\sqrt{10}}{36i^2 - 25} =$
$\frac{-60\sqrt{10} + 50i\sqrt{10}}{-61}$

18) $\frac{(4 - \sqrt{5})(4 + 2\sqrt{5})}{(4 - 2\sqrt{5})(4 + 2\sqrt{5})} =$
$\frac{16 + 8\sqrt{5} - 4\sqrt{5} - 10}{16 - 4(5)} =$
$\frac{6 + 4\sqrt{5}}{-4} = \frac{3 + 2\sqrt{5}}{-2}$

19) $14i(15i + 12i) = 14i(27i) =$
$378i^2 = -378$

20) $i^{20} = (i^2)^{10} = 1$

12F

1) $9X^2 - 12X + 4 = 0$
$(3X - 2)(3X - 2) = 0$
$X = 2/3$

2) $(2X + 3)(X + 2) = 0$
$X = -3/2,\ -2$

3) $16X^2 - 24X + 9 = 0$
$(4X - 3)(4X - 3) = 0$
$X = 3/4$

4) $X^2 - 6X + 1 = 0$
$\frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(1)}}{2(1)} = \frac{6 \pm \sqrt{32}}{2} =$
$\frac{6 \pm 4\sqrt{2}}{2} = 3 \pm 2\sqrt{2}$

5) $4X^2 + 20X + 25 = 0$
$(2X + 5)(2X + 5) = 0$
$X = -5/2$

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

7) 64 $25(X^2 - 16/5\ X + 64/25)$

8) 25 $36(X^2 + 5/3\ X + 25/36)$

9) XY

10) 4/5 X

11) $[3X^2 - 4X - 2 = 0] \div 3$
$X^2 - 4/3\ X + 4/9 = 2/3 + 4/9$
$(X - 2/3)^2 = 10/9$
$\sqrt{(X - 2/3)^2} = \sqrt{10} \div 3$
$X - 2/3 = \pm \frac{\sqrt{10}}{3}$
$X = 2/3 \pm \frac{\sqrt{10}}{3}$

12) $3(2/3 + \sqrt{10}/3)^2 - 4(2/3 + \sqrt{10}/3) - 2 = 0$
$3(4/9 + 4\sqrt{10}/9 + 10/9) - 8/3 - 4\sqrt{10}/3 - 6/3 = 0$
$(4/3 + 4\sqrt{10}/3 + 10/3) - 8/3 - 4\sqrt{10}/3 - 6/3 = 0$
$3(2/3 - \sqrt{10}/3)^2 - 4(2/3 - \sqrt{10}/3) - 2 = 0$
$3(4/9 - 4\sqrt{10}/9 + 10/9) - 8/3 + 4\sqrt{10}/3 - 6/3 = 0$
$(4/3 - 4\sqrt{10}/3 + 10/3) - 8/3 + 4\sqrt{10}/3 - 6/3 = 0$

13) $X^5 + 5X^4(-4) + 10X^3(-4)^2 + 10X^2(-4)^3 +$
$5X(-4)^4 + (-4)^5 =$
$X^5 - 20X^4 + 160X^3 - 640X^2 + 1280X - 1024$

14) $\frac{5 \cdot 4 \cdot 3}{1 \cdot 2 \cdot 3}\ (1/3\ X)^2 2^3 = 10(1/9)(X^2)(8) =$
$80/9\ X^2$

15) $(2X)^3 + 3(2X)^2(9) + 3(2X)(9)^2 + 9^3 =$
$8X^3 + 108X^2 + 486X + 729$

16) $(X - 1/5)^3$

17) $\frac{(6 - 2i)i}{(9i)i} = \frac{6i - 2i^2}{9i^2} = \frac{6i + 2}{-9}$

18) $\frac{(5 + \sqrt{7})\sqrt{7}}{(\sqrt{7})\sqrt{7}} = \frac{5\sqrt{7} + 7}{7}$

19) $\frac{X\ (\sqrt{X} + 2)}{(\sqrt{X} - 2)(\sqrt{X} + 2)} = \frac{X\sqrt{X} + 2X}{X - 4}$

20) $\frac{\sqrt{XA}\,(2\sqrt{A} - 3\sqrt{X})}{(2\sqrt{A} + 3\sqrt{X})(2\sqrt{A} - 3\sqrt{X})} =$
$\frac{2A\sqrt{X} - 3X\sqrt{A}}{4A - 9X}$

13F

1) $(+6)^2 - 4(1)(-7) = 36 + 28 = 64$
real, rational, unequal

2) $(X + 7(X - 1) = 0 \qquad X = -7, 1$

3) $3X^2 - 8X - 2 = 0$
$(-8)^2 - (4)(3)(-2) = 64 + 24 = 88$
real, irrational, unequal

4) $X = \frac{-(-8) \pm \sqrt{88}}{2(3)} = \frac{8 \pm 2\sqrt{22}}{6} = \frac{4 \pm \sqrt{22}}{3}$

5) $4X^2 - 5X + 2 = 0$
$(-5)^2 - (4)(4)(2) = 25 - 32 = -7$
imaginary

6) $X = \frac{-(-5) \pm \sqrt{-7}}{2(4)} = \frac{5 \pm i\sqrt{7}}{8}$

7) $4X^2 - 9X + 5 = 0$
$(-9)^2 - 4(4)(5) = 81 - 80 = 1$
real, rational, unequal

8) $(4X - 5)(X - 1) = 0 \qquad X = 5/4,\ 1$

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

10) $9X^2 - 6X + 2 = 0$
$\frac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(9)}}{2(9)} = \frac{6 \pm \sqrt{-36}}{18} = \frac{6 \pm 6i}{18} = \frac{1 \pm i}{3}$

11) $[5X^2 - 6X - 2 = 0] \div 5$
$X^2 - 6/5\ X + 9/25 = 2/5 + 9/25$
$\sqrt{(X - 3/5)^2} = \sqrt{19/25}$
$X - 3/5 = \pm \frac{\sqrt{19}}{5}$
$X = \frac{3}{5} \pm \frac{\sqrt{19}}{5}$

12) $5\left(\frac{3}{5} + \frac{\sqrt{19}}{5}\right)^2 - 6\left(\frac{3}{5} + \frac{\sqrt{19}}{5}\right) - 2 = 0$
$\frac{9}{5} + \cancel{\frac{6\sqrt{19}}{5}} + \frac{19}{5} - \frac{18}{5} - \cancel{\frac{6\sqrt{19}}{5}} - \frac{10}{5} = 0$
Other value of X works as well.

13) $2X^4 + 4(2X)^3(3) + 6(2X)^2(3)^2 + 4(2X)(3)^3 + 3^4$
$16X^4 + 96X^3 + 216X^2 + 216X + 81$

14) X^3

15) $X^3 + 3(X)^2(2A) + 3(X)(2A)^2 + (2A)^3 =$
$X^3 + 6X^2A + 12XA^2 + 8A^3$

16) $(2X + 3/4)^3$

17) $\left(\frac{12 + \sqrt{-X}}{10}\right)\left(\frac{12 + \sqrt{-X}}{10}\right) =$
$\frac{144 + 24i\sqrt{X} - X}{10}$

18) $\frac{3 + 2\frac{5}{9}}{1\ \frac{1}{4}} = 5\frac{5}{9} \div \frac{5}{4} =$
$\frac{\cancel{50}^{10}}{9} \times \frac{4}{\cancel{5}} = \frac{40}{9}$

19) subtract X from both sides
$\left[\frac{3X + 2}{4} = \frac{X - 9}{3}\right] 12 =$
$9X + 6 = 4X - 36$
$5X = -42$
$X = -42/5$

20) $16 - i^2 = 17$

14F

1) $11.32 \times .45 = 5.09$
$11.32 + 5.09 = 16.41$
price on tag = \$16.00

2) $2.80 \times .45 = 1.26$
$2.80 + 1.26 = 4.06$
price on tag = \$4.00

3) $3.58 \times .45 = 1.61$
$3.58 + 1.61 = 5.19$
price on tag = \$5.00

4) $43.90 \times .0675 = \$2.96$

5) $43.90 \times .15 = \$6.59$

6) final cost = \$53.45
tax and tip = \$9.55
WP x 53.45 = 9.55 = 18%

7) C = 12, 0 = 16
CO = 12 + 16 = 28
$\frac{C}{CO} = \frac{12}{28} = 43\%$

8) $\frac{O}{CO} = \frac{16}{28} = 57\%$

9) $(-10)^2 - 4(5)(-15) = 100 + 300 = 400$
real, rational, unequal

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

11) $9X^2 - 24X + 16 = 0$
$(-24)^2 - 4(9)(16) = 0$
real, rational, equal

12) $(3X - 4)(3X - 4) = 0$
$X = 4/3$

13) $5X^2 - 6X + 2 = 0$
$(-6)^2 - 4(5)(2) = 36 - 40 = -4$
imaginary

14) $\frac{-(-6) \pm \sqrt{(-6)^2 - 4(5)(2)}}{2(5)} = \frac{6 \pm 2i}{10} = \frac{3 \pm i}{5}$

15) $5X^2 - 6X + 9 = 0$
$\frac{-(-6) \pm \sqrt{(-6)^2 - 4(5)(9)}}{2\ (5)} = \frac{6 \pm \sqrt{-144}}{10} = \frac{6 \pm 12i}{10} = \frac{3 \pm 6i}{5}$

16) $5X^2 + 6X + 5 = 0$
$\frac{-6 \pm \sqrt{6^2 - 4(5)(5)}}{2(5)} = \frac{-6 \pm \sqrt{-64}}{10}$
$\frac{-6 \pm 8i}{10} = \frac{-3 \pm 4i}{5}$

17) $X(2X + 1) = 0$
$X = 0, -1/2$

18) $2(0)^2 + 0 = 0$
$2(-1/2)^2 + (-1/2) = 0$
$1/2 - 1/2 = 0$

19) $X^4 + 4X^3(-1) + 6X^2(-1)^2 + 4X(-1)^3 + (-1)^4 =$
$X^4 - 4X^3 + 6X^2 - 4X + 1$

20) $\frac{5}{1}\ (2X)^4(-3)^1 = 5(16)(X^4)(-3) = -240X^4$

15F

1) $L = \frac{V}{WH}$

2) $\frac{S}{N} = \frac{A + L}{2}$ $\quad \frac{2S}{N} = A + L$

$\frac{2S}{N} - L = A$

3) $A \cdot \frac{2}{H} = \frac{H}{2}(B_1 + B_2)$ $\quad \frac{2A}{H} = (B_1 + B_2)$

$B_1 = \frac{2A}{H} - B_2$

4) $\frac{L - A}{D} = \frac{(N - 1)D}{D}$ $\quad \frac{L - A}{D} = (N - 1)$

$\frac{L - A}{D} + 1 = N$

5) $C = \frac{5}{9}(F - 32)$

$\frac{9}{5} C = F - 32$ $\quad \frac{9}{5} C + 32 = F$

6) $I(R + r) = E$

7) 1 of 10 $\quad \frac{1}{10} = 10\%$

8) 9 of 10 $\quad \frac{9}{10} = 90\%$

9) 10% 0f 530 = 53

10) 30% of 530 = 159

11) C = 12, S = 32

$CS_2 = 12 + 32 + 32 = 76$

$\frac{C}{CS_2} = \frac{12}{76} = 16\%$

12) $\frac{S_2}{CS_2} = \frac{64}{76} = 84\%$

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

$(-2)^2 - 4(1)(5) = -16$

imaginary

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

$1 \pm 2i$

15) $2X^2 - X - 3 = 0$

$(-1)^2 - 4(2)(-3) = 1 + 24 = 25$

real, rational, unequal

16) $(2X - 3)(X + 1) = 0$ $\quad X = (3/2, -1)$

17) $X^2 + 4X - 5 = 0$

$\frac{-4 \pm \sqrt{16 - 4(1)(-5)}}{2} = \frac{-4 \pm 6}{2} =$

$X = (1, -5)$

18) $3X^2 + 5X - 1 = 0$

$\frac{-5 \pm \sqrt{25 - 4(3)(-1)}}{6} = \frac{-5 \pm \sqrt{37}}{6}$

19) multiply each term by 100

$300 - 5X = 20X - 125$

$425 = 25X$

$X = 17$

20) multiply each term by 7

$X - 8 + 7X = 28$

$8X = 36$

$X = 4\ 1/2$

16F

1) $\frac{G}{T} = \frac{1}{9}$, $\quad \frac{HO}{T} = \frac{8}{9}$, $\quad \frac{G}{HO} = \frac{1}{8}$

2) $\frac{G}{HO} = \frac{1}{8}$ We need to know HO and we are given G.

3) $\frac{G}{HO} = \frac{1}{8}$ $\quad \frac{1{,}180}{HO} = \frac{1}{8}$

$HO\ (1) = 1{,}180 \times 8$

$HO = 9{,}440$ trains

4) $\frac{C_2}{C_2H_4} = \frac{24}{28}$, $\quad \frac{H_4}{C_2H_4} = \frac{4}{28}$,

$\frac{H_4}{C_2} = \frac{4}{24}$

5) $\frac{C_2}{C_2H_4} = \frac{24}{28} = \frac{M_C}{168}$

$\frac{24 \cdot 168}{28} = 144$ $\quad M_C = 144$ g

6) $\frac{H_4}{C_2H_4} = \frac{4}{28} = \frac{M_H}{168}$

$\frac{4 \times 168}{28} = 24$ $\quad M_H = 24$ g

7) $\frac{C}{CF_4} = \frac{12}{88}$, $\quad \frac{F_4}{CF_4} = \frac{76}{88}$,

$\frac{C}{F_4} = \frac{12}{76}$

8) $\frac{C}{CF_4} = \frac{12}{88} = \frac{M_C}{616}$

$\frac{12 \times 616}{88} = M_C = 84$ g

9) $\frac{F_4}{CF_4} = \frac{76}{88} = \frac{M_F}{616}$

$\frac{76 \times 616}{88} = M_F = 532$ g

10) $S(I - R) = A - RL$

$SI - SR = A - RL$

$RL - SR = A - SI$

$R(L - S) = A - SI$

$R = \frac{A - SI}{L - S}$

11) $S(I - R) = A - RL$

$S(I - R) + RL = A$

12) 42% savings, so 58% of the bill is $268.

58% B = 268

$B = \frac{268}{.58} = \$462.07$ for previous bill

13) increase is 294.80 - 268.00 = 26.80

WP x 268 = 26.80

$WP = \frac{26.80}{268} = 10\%$

14) $\frac{Na_3}{Na_3PO_4} = \frac{69}{69 + 31 + 4(16)} = \frac{69}{164} = 42\%$

15) $\frac{P}{Na_3PO_4} = \frac{31}{164} = 19\%$

16) $\frac{O_4}{Na_3PO_4} = \frac{64}{164} = 39\%$

17) $b^2 - 4ac$ $\quad (-5)^2 - 4(1)(8) = 25 - 32 = -7$

imaginary

18) $\frac{-(-5) \pm \sqrt{-7}}{2(1)} = \left(\frac{5 + \sqrt{-7}}{2}, \frac{5 - \sqrt{-7}}{2}\right)$

$\left(\frac{5 + i\sqrt{7}}{2}, \frac{5 - i\sqrt{7}}{2}\right)$

19) multiply all terms by 10

$2(4X - 3) - (5 - 3X) = 5(X - 1)$

$8X - 6 - 5 + 3X = 5X - 5$

$11X - 11 = 5X - 5$

$6X = 6, \quad X = 1$

20) multiply all terms by 12

$4(4X) - 2(5X) = 3(3X) + 2(12)$

$16X - 10X = 9X + 24$

$6X = 9X + 24$

$3X = 24, \quad X = -8$

17F

1) $\frac{13\ \text{gal}}{1} \times \frac{4\ \text{qts.}}{1\ \text{gal}} = 52\ \text{qts.}$

2) $\frac{7.94\ \text{m}}{1} \times \frac{1000\ \text{mm}}{1\ \text{m}} = 7{,}940\ \text{mm}$

3) $\frac{1\ \text{ft.}}{1} \times \frac{1\ \text{ft.}}{1} \times \frac{1\ \text{ft.}}{1} \times \frac{12\ \text{in.}}{1\ \text{ft.}} \times \frac{12\ \text{in.}}{1\ \text{ft.}} \times \frac{12\ \text{in.}}{1\ \text{ft.}} =$

$1{,}728\ \text{in.}^3$

4) $\frac{11\ \text{yd.}}{1} \times \frac{1\ \text{yd.}}{1} \times \frac{1\ \text{yd.}}{1} \times \frac{3\ \text{ft.}}{1\ \text{yd.}} \times \frac{3\ \text{ft.}}{1\ \text{yd.}} \times \frac{3\ \text{ft.}}{1\ \text{yd.}} =$

$297\ \text{ft.}^3$

5) $\frac{31{,}760\ \text{cm}}{1} \times \frac{1\ \text{cm}}{1} \times \frac{1\ \text{cm}}{1} \times$

$\frac{1\ \text{m}}{100\ \text{cm}} \times \frac{1\ \text{m}}{100\ \text{cm}} \times \frac{1\ \text{m}}{100\ \text{cm}} = .03176\ \text{m}^3$

6) $\frac{128\ \text{in.}}{1} \times \frac{2.5\ \text{cm}}{1\ \text{in.}} \times \frac{1\ \text{m}}{100\ \text{cm}} = 3.2\ \text{m}$

7) $\frac{400\ \text{oz.}}{1} \times \frac{28\ \text{g}}{1\ \text{oz}} \times \frac{1\ \text{kg}}{1000\ \text{g}} = 11.2\ \text{kg}$

8) $\frac{19\ \text{m}}{1} \times \frac{1.1\ \text{yd.}}{1\ \text{m}} \times \frac{36\ \text{in.}}{1\ \text{yd.}} = 752.4\ \text{in.}$

9) $\frac{8\ \text{km}}{1} \times \frac{.62\ \text{mi}}{1\ \text{km}} = 4.96\ \text{mi.}$

10) $\frac{50\ \text{gal.}}{1} \times \frac{4\ \text{qt.}}{1\ \text{gal.}} \times \frac{.95\ \ell}{1\ \text{qt.}} = 190\ \ell$

11) $\frac{C}{C\,S_2} = \frac{12}{76}$, $\frac{S_2}{C\,S_2} = \frac{64}{76}$,

$\frac{C}{S_2} = \frac{12}{64}$

12) $\frac{M_C}{1976} = \frac{12}{76}$

$M_C = \frac{12 \times 1976}{76} = 312\ \text{g}$

13) $\frac{M_S}{1976} = \frac{64}{76}$

$M_S = \frac{64 \times 1976}{76} = 1{,}664\ \text{g}$

14) $\frac{M}{T} = \frac{1}{4}$, $\frac{\text{Other}}{T} = \frac{3}{4}$,

$\frac{M}{O} = \frac{1}{3}$

15) given mocha, looking for total, so

$\frac{M}{T} = \frac{1}{4}$

16) $\frac{M}{T} = \frac{28}{T} = \frac{1}{4}$

$4 \times 28 = T \times 1$

$112 = T$

17) $(S + Q)(R - P) = T$

$S + Q = \frac{T}{R - P}$

$S = \frac{T}{R - P} - Q$

18) $(R - P)(S + Q) = T$

19) $\frac{N}{NF_3} = \frac{14}{14 + (19)(3)} = \frac{14}{71} = 19.7\%$

20) $\frac{F_3}{NF_3} = \frac{57}{71} = 80.3\%$

18F

1) $D = RT$ $\quad T = \frac{D}{R} = \frac{2\ \text{mi.}}{4\ \text{m/h}} = 1/2\ \text{hrs.}$

2) $D = RT$ $\quad D = 5\ \text{m/h} \times 3/4 = 3\ 3/4\ \text{mi.}$

3) $D = RT$ $\quad R = \frac{D}{T} = \frac{4.5\ \text{mi.}}{.75\ \text{hr.}} = 6\ \text{mph}$

4 - 5) $\Longrightarrow$

$D_S = D_A$

$R_S T_S = R_A T_A$

$(75)(7\ 2/3) = (R_A)(T_A)$ ← $R_S = 75$; $R_A = 75 - 6 = 69$; $T_S = 8{:}40 - 1{:}00 = 7{:}40$ hrs. or $7\ 2/3$ hrs.

$575 = 69\ T_A$

$8\ 1/3 = T_A$

1:00 PM + 8:20 = 9:20 PM

$D = 75 \times 7\ 2/3 = 575$ mi.

6 - 7) $\Longleftarrow$

$D_A = D_S$

$R_A T_A = R_S T_S$

$(60)(10) = (75)(T_S)$ ← $R_A = 60$; $T_A = 10$ hrs.; $R_S = 60 + 15 = 75$

$600 = 75\ T_S$

$8 = T_S$

$D = 60 \times 10 = 600$ mi.

or $D = 75 \times 8 = 600$ mi.

8) $\frac{46\ \text{lbs.}}{1} \times \frac{16\ \text{oz.}}{1\ \text{lb.}} = 736\ \text{oz.}$

9) $\frac{705\ \text{cm}}{1} \times \frac{1\ \text{m}}{100\ \text{cm}} = 7.05\ \text{cm}$

10) $\frac{.5\ \text{m}}{1} \times \frac{1\ \text{m}}{1} \times \frac{1\ \text{m}}{1} \times \frac{1000\ \text{mm}}{1\ \text{m}} \times \frac{1000\ \text{mm}}{1\ \text{m}} \times \frac{1000\ \text{mm}}{1\ \text{m}}$

$= 5 \times 10^8\ \text{mm}^3$

11) $\frac{696\ \text{in.}}{1} \times \frac{1\ \text{in.}}{1} \times \frac{1\ \text{yd.}}{36\ \text{in.}} \times \frac{1\ \text{yd.}}{36\ \text{in.}} =$

$.54\ \text{yd.}^2$

12) $\frac{16\ \text{lbs.}}{1} \times \frac{.45\ \text{kg}}{1\ \text{lbs.}} = 7.2\ \text{kg.}$

13) $\frac{40\ \ell}{1} \times \frac{1.06\ \text{qts.}}{1\ \ell} \times \frac{1\ \text{gal.}}{4\ \text{qts.}} = 10.6\ \text{gal.}$

14) $\frac{M}{NM} = \frac{3}{2}$, $\frac{M}{T} = \frac{3}{5}$,

$\frac{NM}{T} = \frac{2}{5}$

15) $\frac{M}{T} = \frac{3}{5}$

given M and looking for T

16) $\frac{M}{T} = \frac{3}{5} = \frac{135}{T}$

$3T = 5 \times 135$

$T = \frac{675}{3} = 225$ boats

17) $B\left(\frac{A}{X + Y}\right) = X$

$B = X\left(\frac{X + Y}{A}\right)$

18) $\frac{Fe}{FeCl_3} = \frac{56}{56 + 105} = \frac{56}{161} = 34.8\%$

19) $\frac{Cl_3}{FeCl_3} = \frac{105}{161} = 65.2\%$

20) $(A)^3 + 3(A)^2(2X) + 3(A)^1(2X)^2 + (2X)^3 =$

$A^3 + 6A^2X + 12AX^2 + 8X^3$

19F

1) Situps = RT 50 x 3 = 150 situps

2) $S = RT \quad R = \frac{S}{T} = \frac{212}{2} = 106$ per day

3) $S = RT \quad T = \frac{S}{R} = \frac{300}{60} = 5$ days

4 - 5) $D_H = D_S$

$R_HT_H = R_ST_S$
$R_H(20) = (R_H + 10)(16)$
$20R_H = 16R_H + 160$
$4R_H = 160$
$R_H = 40$
$R_S = R_H + 10 = 40 + 10 = 50$

$R_S = R_H + 10$, $T_S = 16$, $T_H = 20$

6 - 8) 26 mi. (D_J, D_C)

$D_J + D_C = 26$
$R_JT_J + R_CT_C = 26$
$(R_C + 1)(2) + (R_C)(2) = 26$
$2R_C + 2 + 2R_C = 26$
$4R_C = 24$
$R_C = 6$
$R_J = R_C + 1$
$R_J = 6 + 1 = 7$

$T_J = 2$, $T_C = 2$, $R_J = R_C + 1$

9 - 11) 49 mi. (D_R, D_T)

$D_R + D_T = 49$
$R_RT_R + R_TT_T = 49$
$(4\ 1/2)(6) + (R_T)(4) = 49$
$27 + 4R_T = 49$
$4R_T = 22$
$R_T = 5.5$ mph
$D_T = (5.5)(4) = 22$
$D_R = (4\ 1/2)(6) = 27$

$R_R = 4\ 1/2$, $T_R = 6$, $T_T = T_R - 2 = 6 - 2 = 4$

12) $\frac{132 \text{ m}}{1} \times \frac{1 \text{ m}}{1} \times \frac{1 \text{ m}}{1} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{100 \text{ cm}}{1 \text{ m}}$

$= 132{,}000{,}000$ or 1.32×10^8 cm^3

13) $\frac{5000 \text{ mm}}{1} \times \frac{1 \text{ mm}}{1} \times \frac{1 \text{ mm}}{1} \times \frac{1 \text{ cm}}{10 \text{ mm}} \times \frac{1 \text{ cm}}{10 \text{ mm}} \times \frac{1 \text{ cm}}{10 \text{ mm}} = 5$ cm^3

14) $\frac{75 \text{ L}}{1} \times \frac{1.06 \text{ qts.}}{1 \text{ L}} = 79.5$ qts.

15) $\frac{100 \text{ yds.}}{1} \times \frac{.9 \text{ m}}{1 \text{ yd.}} = 90$ m

16) $\frac{ST}{SP} = \frac{5}{3}$, $\frac{ST}{T} = \frac{5}{8}$, $\frac{SP}{T} = \frac{3}{8}$

17) $\frac{ST}{T} = \frac{5}{8}$

given strikes, looking for total

18) $\frac{ST}{T} = \frac{5}{8} = \frac{180}{\text{Marks}}$

$5M = 1{,}440$
$M = 288$

19) $2A^2 - 20A + 6 = 0$
$A^2 - 10A + 3 = 0$
$A^2 - 10A + 25 = 25 - 3$
$(A - 5)^2 = 22$
$A - 5 = \pm \sqrt{22}$
$A = 5 \pm \sqrt{22}$

20) $B^2 + 4B + 5 = 0$

$\frac{-4 \pm \sqrt{4^2 - 4(1)(5)}}{2(1)} = \frac{-4 \pm \sqrt{16 - 20}}{2}$

$\frac{-4 \pm \sqrt{-4}}{2} = \frac{-4 \pm 2i}{2} = -2 \pm i$

20F

1) negative $\frac{\text{up } 12}{\text{over } -4} = -3$

2) b -4
if m = -3 + b = -4, then Y = -3X - 4

3) $Y = -3X + b$
$(1) = -3(-1) + b$
$1 = 3 + b \quad b = -2$

4) $Y = -3X - 2$

5) $3X + Y = -2$

6) on the graph

7) $m = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{2 - 0}{4 - (-4)} = \frac{2}{8} = \frac{1}{4}$

$Y = 1/4\ X + b \quad (2) = 1/4\ (4) + b$

$2 = 1 + b \quad b = 1$

8) $Y = 1/4\ X + 1$

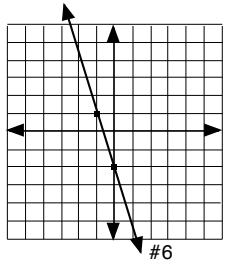
9) $[Y = 1/4\ X + 1]\ 4$
$4Y = X + 4$
$-Y + 4Y = 4$

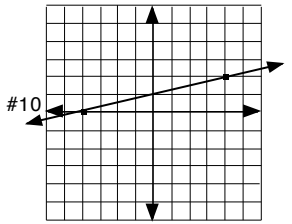
10) on the graph

11 -13) 240 (D_J, D_E)

$D_J + D_E = 240$
$R_JT_J + R_ET_E = 240$
$(12)(T_E + 2) + (60)(T_E) = 240$
$12\ T_E + 24 + 60T_E = 240$
$72T_E = 216, \quad T_E = 3$
$T_J = 3 + 2 = 5$
$D_J = (12)(5) = 60, \quad D_E = (60)(3) = 180$

$R_J = 12$, $R_E = 60$, $T_J = T_E + 2$





14 -15) D_U, D_D

$D_U = D_T$
$R_UT_U = R_DT_D$
$(24)(1.5) = (48)(T_D)$
$36 = 48T_D$
$.75 = T_D$
$D = (.75)(48)$ or $(24)(1.5) = 36$ miles

$R_U = 24$, $T_U = 1.5$, $R_D = 2(R_U) = 2(24) = 48$

16) $\frac{2.5 \text{ yd.}}{1} \times \frac{1 \text{ yd.}}{1} \times \frac{1 \text{ yd.}}{1} \times \frac{3 \text{ ft.}}{1 \text{ yd.}} \times \frac{3 \text{ ft.}}{1 \text{ yd.}} \times \frac{3 \text{ ft.}}{1 \text{ yd.}} = 67.5$ ft.^{3}

17) $\frac{37 \text{ mi.}}{1} \times \frac{5280 \text{ mi.}}{1 \text{ mi.}} \times \frac{1 \text{ yd.}}{3 \text{ ft.}} = \frac{(37)(5280)}{3} =$ 65,120 yds.

18) $\frac{M_S}{1804} = \frac{69}{164}$, $M_S = \frac{69(1804)}{164} = 759$ g

19) $\frac{M_P}{1804} = \frac{31}{164}$, $M_P = \frac{31(1804)}{164} = 341$ g

20) $\frac{M_O}{1804} = \frac{64}{164}$, $M_O = \frac{64(1804)}{164} = 704$ g

21F

1) $2Y = 4X - 3$ $\quad Y = -1/2X + b$
$Y = 2X - 3/2$ $\quad (2) = -1/2(2) + b$
$m = -1/2$ (negative reciprocal) $\quad 3 = b$

2) $Y = -1/2\ X + 3$

3) $[Y = -1/2\ X + 3]\ 2 \quad 2Y = -X + 6$
$X + 2Y = 6$

4) on the graph

5) $Y = -1/4\ X + 3/2$

6) (0, 0), (0, 4)

7) $-4Y \le X - 6 \quad Y \ge -1/4\ X + 3/2$
$Y \ge -1/4\ X + 3/2 \quad (4) > -1/4\ (0) + 3/2$
$(0) \ge -1/4\ (0) + 3/2 \quad 4 \ge 0$, yes
$0 \ge 3/2$, no

8) on the graph - solid line

9) $m = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{-1 - (-3)}{-2 - 4} = \frac{2}{-6} = \frac{-1}{3} = m$

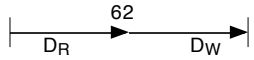
$Y = 1/3\ X + b \quad (-3) = -1/3(4) + b$
$-9/3 = -4/3 + b$
$-5/3 = b$

10) $Y = -1/3\ X - 5/3$

11) $[1/3\ X + Y = -5/3]\ 3 \quad X + 3Y = -5$

12) on the graph

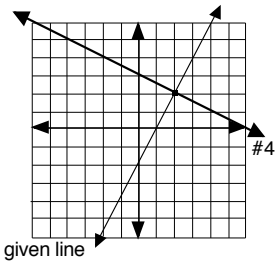
13 -15)

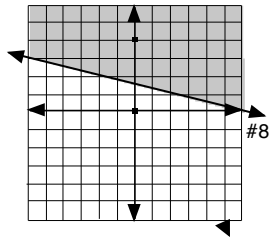


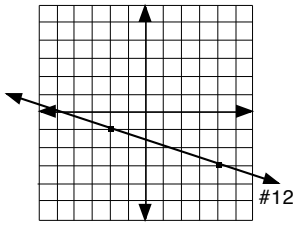
$R_R = R_W + 4$
$T_R = 5$
total time = $T_R + T_W = 7$
$5 + T_W = 7$
$T_W = 2$

$R_R T_R + R_W T_W = 62$
$(R_W + 4)(5) + (R_W)(2) = 62$
$5R_W + 20 + 2R_W = 62$
$7R_W = 42, \quad R_W = 6$

$R_R = 6 + 4 = 10$







16) $\frac{428{,}000\ \cancel{mm}}{1} \times \frac{1\ \cancel{mm}}{1} \times \frac{1\ \cancel{mm}}{1} \times$

$\frac{1\ cm}{10\ \cancel{mm}} \times \frac{1\ cm}{10\ \cancel{mm}} \times \frac{1\ cm}{10\ \cancel{mm}} = 428\ cm^3$

17) $\frac{9\cancel{cm}}{1} \times \frac{.4\ in.}{\cancel{cm}} = 3.6\ in.$

18) $\frac{M_C}{384} = \frac{24}{64}$, $M_C = \frac{24(384)}{64} = 144\ g$

19) $\frac{M_H}{384} = \frac{5}{64}$, $M_H = \frac{5(384)}{64} = 30\ g$

20) $\frac{M_{Cl}}{384} = \frac{35}{64}$, $M_{Cl} = \frac{35(384)}{64} = 210\ g$

22F

1-3) on the graph

4) 6,8 (see graph)

5) $EC^2 = 6^2 + 8^2 = 100$
$EC = \sqrt{100} \quad EC = 10$

6) $DB^2 = 16 + 16 = 32$
$DB = \sqrt{32} \quad DB = 4\sqrt{2}$

7) $AE^2 = 4 + 64 = 68$
$AE = \sqrt{68} \quad AE = 2\sqrt{17}$

8) $DE^2 = 25 + 4 = 29$
$DE = \sqrt{29}$

9) $\left(\frac{-2 - 3}{2}\right), \left(\frac{3 - 3}{2}\right) = \left(-2\frac{1}{2}, 0\right)$

10) $\left(\frac{-5 + 2}{2}\right), \left(\frac{5 + (-1)}{2}\right) = \left(-1\frac{1}{2}, 2\right)$

11) $\left(\frac{-2 + 3}{2}\right), \left(\frac{3 + 5}{2}\right) = \left(\frac{1}{2}, 4\right)$

12) $m = \frac{-2 - 3}{1 - (-1)} = \frac{-5}{2}$

$Y = -5/2\ X + b \quad (3) = -5/2(-1) + b$
$6/2 = 5/2 + b \quad b = 1/2$
$Y = -5/2\ X + 1/2$

13) on the graph

14) $Y = 5/3\ X + b \quad (-4) = 5/3\ (-1) + b$
$-12/3 + 15/3 = b \quad b = -7/3$
$Y = 5/3\ X - 7/3$

15) on the graph

16) $m = 2/3$, so perpendicular is $-3/2$

$Y = -3/2\ X + b \quad (3) = -3/2\ (1) + b$
$4\ 1/2 = b$
$Y = -3/2\ X + 4\ 1/2$

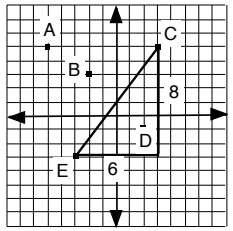
17) on the graph

18) on the graph
$-Y \ge -2X + 1 \quad Y \le 2X - 1$

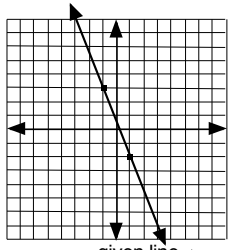
19) $(0) \le 2(0) - 1 \quad (-1) \le 2(1) - 1$
$0 \le -1$ no $\quad -1 \le 1$ yes

20) solid, on the graph

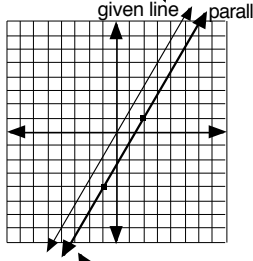
#1-5



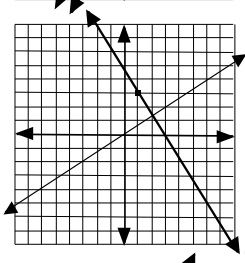
#12-13



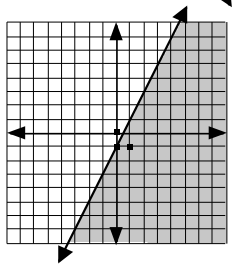
#14-15



#16-17



#18-20



23F

1) $(X - 0)^2 + (Y - 1)^2 = 7^2$
C = (0, 1) R = 7

2) on the graph

3) $(X + 3)^2 + (Y - 2)^2 = 4^2$ C = (-3, 2) R = (4)

4) on the graph

5) $(X - 0)^2 + Y^2 - 4Y + 4 = 5 + 4$
$(X - 0)^2 + (Y - 2)^2 = 3^2$
C = (0, 2) R = 3

6) on the graph

7) (2, 0)

8) If X=2, X term = 0 $Y^2 = 9$ $Y = \pm 3$

9) If Y=0, Y term = 0 $(X-2)^2 = 4$ $X-2 = \pm 2$, X = 4, 0

10) on the graph

11) $AC^2 = 25 + 81 = 106$
$AC = \sqrt{106}$

12) $BC^2 = 4 + 64 = 68$
$BC = \sqrt{68} = 2\sqrt{17}$

13) $\left(\frac{-2 + 3}{2}\right), \left(\frac{7 - 2}{2}\right) = \left(\frac{1}{2}, 2\frac{1}{2}\right)$

14) $\left(\frac{-2 - 5}{2}\right), \left(\frac{7 - 4}{2}\right) = \left(-3\frac{1}{2}, 1\frac{1}{2}\right)$

15) $3Y = -6X + 2$ $Y = -2X + 2/3$
$Y = -2X + b$ $(3) = -2(1) + b$
$5 = b$ $Y = -2X + 5$

16) on the graph

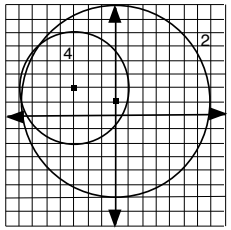
17) $Y = 3/4X + 1/2$, $m = 3/4$ so perpendicular is -4/3
$Y = -4/3\ X + b$ $(0) = -4/3(4) + b$
$16/3 = b$ $Y = -4/3\ X + 16/3$

18) on the graph
$[3Y > 2X + 3] \div 3$ $Y > 2/3\ X + 1$

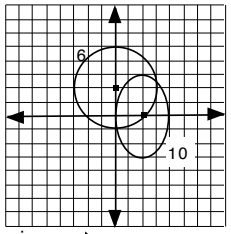
19) $(0) > 2/3(0) + 1$ $(3) > 2/3\ (0) + 1$
$0 > 1$ no $3 > 1$ yes

20) dotted, on the graph

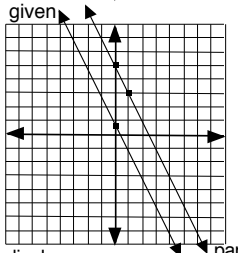
#2 & 4



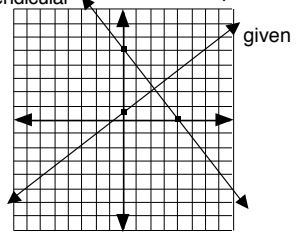
#6 & 10



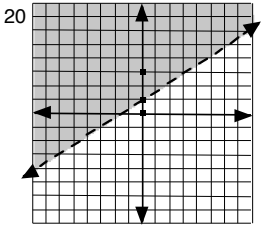
#16



#18



#19 & 20



24F

1-2) $Y = 3X^2 - 2$

X	Y
0	-2
1	1
-1	1
2	10
-2	10

see graph

3-4) $Y = X^2 + 2$

X	Y
0	2
1	3
-1	3
2	6
-2	6

see graph

5) -1

6) +1

7) +2

8) -2

9) $X^2 + 2X + 1 + Y^2 - 6Y + 9 = 6 + 10$
$(X + 1)^2 + (Y - 3)^2 = 4^2$
C = (-1, 3) R = 4

10) on the graph

11) $(X + 3)^2 + (Y - 0)^2 = 4^2$
$(X + 3)^2 + Y^2 = 16$

12) on the graph

13) (3, 0)

14) X term = 0 $Y = \pm 6$
Y term = 0 $X = 5, 1$

15) $AB^2 = (-4 - 5)^2 + [-3 - (-1)]^2 = 81 + 4 = 85$
$AB = \sqrt{85}$

16) $AC^2 = [-4 - 2]^2 + [-3 - (-5)]^2 = 36 + 4 = 40$
$AC = 2\sqrt{10}$

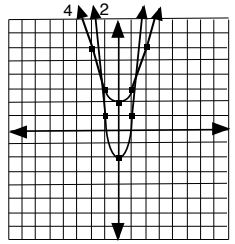
17) $\left(\frac{5 + 2}{2}\right), \left(\frac{-1 - 5}{2}\right) = \left(3\frac{1}{2}, -3\right)$

18) $\left(\frac{-4 + 2}{2}\right), \left(\frac{-3 - 5}{2}\right) = (-1, -4)$

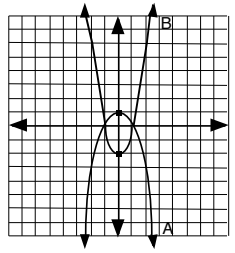
19) $5Y = 4X + 15$ $Y = 4/5\ X + 3$
m = 4/5 so perpendicular is -5/4
$Y = -5/4\ X + b$ $(1) = -5/4(-2) + b$
$1 = 5/2 + b$ $-3/2 = b$
$Y = -5/4\ X - 3/2$

20) $-2Y \geq -X + 5$ $Y \leq 1/2\ X - 5/2$
$(0) \leq 1/2(0) - 5/2$ $(-4) \leq 1/2\ (0) - 5/2$
$0 \leq -5/2$ no $-4 \leq -5/2$ yes

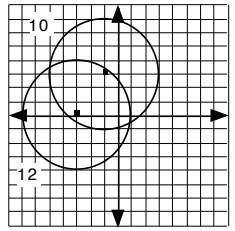
#2 & 4



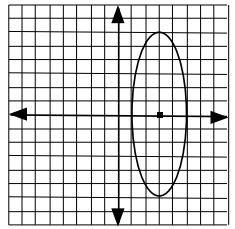
#5-8



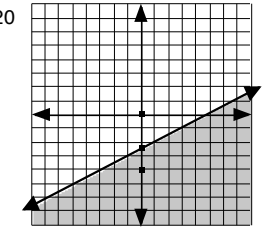
#10&12



#14



#20



25F

1) $4Y = -4X^2 - 20X + 4$ $\quad -Y = X^2 - 5X + 1$

$\frac{-B}{2A} = \frac{-(-5)}{2(-1)} = \frac{-5}{2}$

2) $Y = -(-5/2)^2 - 5(-5/2) + 1 = 7\ 1/4$

3) on the graph

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

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

5) $Y = 3(-1/2)^2 + 3(-1/2) + 2 = 1\ 1/4$

6) on the graph

7) $Y = X^2$

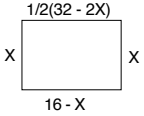
8) $\frac{-B}{2A}$, $A\left(\frac{-B}{2A}\right)^2 + B\left(\frac{-B}{2A}\right) + C$

9-10) $\text{Area} = X(16 - X) = 16X - X^2$

$\frac{-B}{2A} = \frac{-16}{2(-1)} = 8$

$A = 16(8) - (8)^2 = 64$

Dimensions: 8' x 8'



11) $Y = -3X^2 - 1$ (on the graph)

12) $Y = X^2 + 3$ (on the graph)

13) $[5(X + 2)^2 + 5(Y - 1)^2 = 45] \div 5$

$(X + 2)^2 + (Y - 1)^2 = 3^2$

C = (-2, 1) $\quad$ R = 3

14) $(X - 0)^2 + (Y - 0)^2 = 8^2 \quad X^2 + Y^2 = 64$

15-16) $X^2 - 4X + 4 + Y^2 + 2Y + 1 = 20 + 5$

$(X - 2)^2 + (Y + 1)^2 = 5^2$

C = (2, -1) $\quad$ R = 5

17) $AB^2 = (-3 - 0)^2 + (0 - 4)^2 = 9 + 16 = 25$

AB = 5

18) $\left(\frac{0 + 5}{2}\right), \left(\frac{0 + 4}{2}\right) = \left(2\frac{1}{2}, 2\right)$

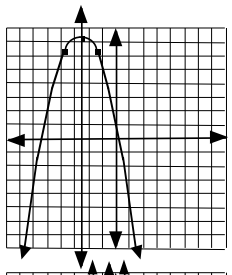
19) $[-Y > -2/5\ X + 5/2]\ (-1) \quad Y < 2/5\ X - 5/2$

20) on the graph

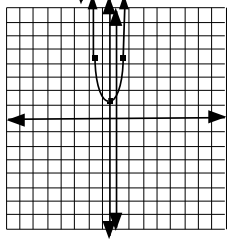
$(0) < 2/5(0) - 5/2 \quad (-5) < 2/5(0) - 5/2$

$0 < -5/2$ no $\quad -5 < 5/2$ yes

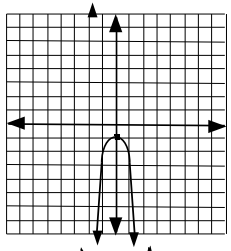
#3



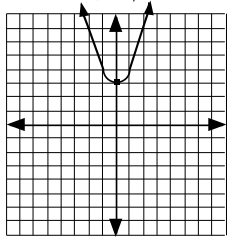
#6



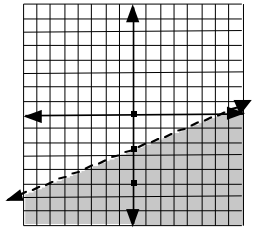
#11



#12



#20



26F

1-2) $XY = 10$

X	Y
2	5
5	2
-2	-5
-5	-2

see graph

3-4) $XY = -4$

X	Y
1	-4
2	-2
4	-1
-1	4
-2	2
-4	1

see graph

5-6) $X^2 - 2Y^2 = 8$

X	Y
±2.8	0
±4	±2
±7.6	±5

see graph

7) $\frac{-3}{2(1/2)} = -3$

8) $Y = 1/2\ (3)^2 + 3\ (-3) - 1 = -5\ 1/2$

9) on the graph

10) $[10Y + 30X^2 - 20 = 0] \div 10 \quad Y + 3X^2 - 2 = 0$

$Y = -3X^2 + 2$

11) $[5 + 5Y = 10X^2] \div 5 \quad 1 + Y = -2X^2$

$Y = -2X^2 - 1$

12) $[-(X - 4)^2 - 5(Y + 4)^2 = -121]\ (-1)$

$(X - 4)^2 + (Y + 4)^2 = 11^2$

C = (4, -4) $\quad$ R = 11

13) $(X - 2)^2 + (Y - 0)^2 = 7^2 \quad (X - 2)^2 + Y^2 = 49$

14-15) $X^2 + Y^2 - 2Y + 1 = 3 + 1$

$(X - 0)^2 + (Y - 1)^2 = 2^2$

C = (0, 1) $\quad$ R = 2

16) $AD^2 = (-2 - 4)^2 + [5 - (-4)]^2 = 36 + 81 = 117$

$AD = \sqrt{117} = 3\sqrt{13}$

17) $\left(\frac{-2 + 4}{2}, \frac{5 - 4}{2}\right) = \left(1, \frac{1}{2}\right)$

18) $Y = -2/3\ X - 2 \quad m = -2/3$ so perpendicular is 3/2

$Y = 3/2\ X + b \quad (-3) = 3/2\ (-3) + b$

$1\ 1/2 = b \quad Y = 3/2\ X + 3/2$

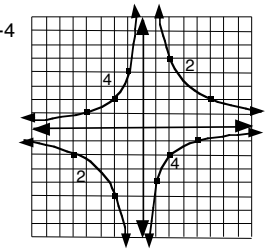
19) C = (-1, 1)

with new center $\quad X = 0 \quad Y = \pm 4$

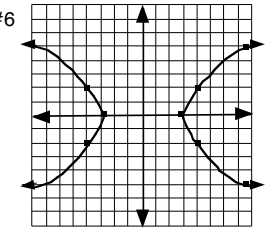
$Y = 0 \quad X = \pm 3$

20) on the graph

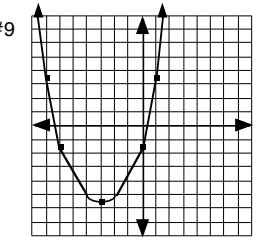
#2-4



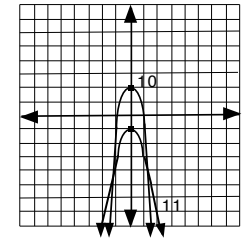
#6



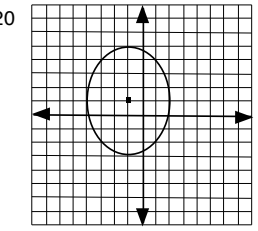
#9



#10-11



#20



27F

1) line and ellipse

2) on the graph

3) $X^2 + 4(2X - 3)^2 = 16 \qquad 17X^2 - 48X + 20 = 0$

4) $X = \dfrac{-(-48) \pm \sqrt{(-48)^2 - 4(17)(20)}}{2(17)}$

$X = \left(\dfrac{24 + 2\sqrt{59}}{17}\ ,\ \dfrac{24 - 2\sqrt{59}}{17}\right)$

5) $Y = 2\left(\dfrac{24 + 2\sqrt{59}}{17}\right) - 3, \quad Y = 2\left(\dfrac{24 - 2\sqrt{59}}{17}\right) - 3$

6) $\left(\dfrac{24 + 2\sqrt{59}}{17}\ ,\ \dfrac{4\sqrt{59} - 3}{17}\right)\left(\dfrac{24 - 2\sqrt{59}}{17}\ ,\ \dfrac{-4\sqrt{59} - 3}{17}\right)$

$\sqrt{59} \quad 7.7$

7) parabola, line

8) on the graph

9) $2Y = -X^2 - 6X$ and $2Y = 4/5\ X - 5$

$[4/5\ X - 5 = -X^2 - 6X]\ 5 \qquad 4X - 25 = -5X^2 - 30X$

$5X^2 + 34X - 25 = 0$

10) $X = \dfrac{-17 \pm 3\sqrt{46}}{5}$ (from quadratic formula)

11) $Y = \dfrac{2}{5}\left(\dfrac{-17 + 3\sqrt{46}}{5}\right) - \dfrac{5}{2}, \quad Y = \dfrac{2}{5}\left(\dfrac{-17 - 3\sqrt{46}}{5}\right) - \dfrac{5}{2}$

12) $\left(\dfrac{-17 + 3\sqrt{46}}{5}\ ,\ \dfrac{-193 + 12\sqrt{46}}{50}\right)$

$\left(\dfrac{-17 - 3\sqrt{46}}{5}\ ,\ \dfrac{-193 - 12\sqrt{46}}{50}\right)$

13) hyperbola, ellipse

14) ellipse $C = (0, 0), \quad X = \pm 3, \ Y = \pm 2$

15) $-4(X^2 - 2Y^2 = 8) \qquad -4X^2 + 8Y^2 = -32$

$4X^2 + 9Y^2 = 36$

$17Y^2 = 4$

hyperbola

X	Y
± 2.85	0
± 4	4
± 6.3	8

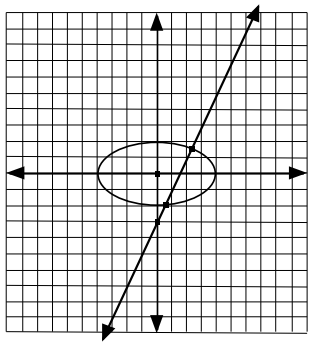
16) $Y = \pm\sqrt{4/17} \qquad Y = \pm\dfrac{2\sqrt{17}}{17}$

17) $X^2 - 2\left(\dfrac{\pm 2\sqrt{17}}{17}\right)^2 = 8 \qquad X = \pm\dfrac{12\sqrt{17}}{17}$

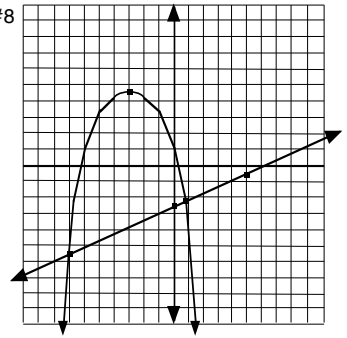
18) $\left(\dfrac{12\sqrt{17}}{17}\ ,\ \dfrac{2\sqrt{17}}{17}\right)\left(\dfrac{12\sqrt{17}}{17}\ ,\ \dfrac{-2\sqrt{17}}{17}\right)$

$\left(\dfrac{-12\sqrt{17}}{17}\ ,\ \dfrac{2\sqrt{17}}{17}\right)\left(\dfrac{-12\sqrt{17}}{17}\ ,\ \dfrac{-2\sqrt{17}}{17}\right)$

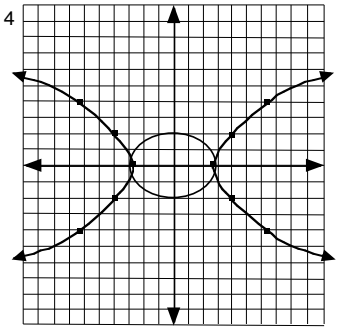
#2



#8



#14



19) $CD^2 = [3 - (-2)]^2 + [-2 - (-4)]^2 =$

$25 + 4 = 29 \qquad CD = \sqrt{29}$

20) $\left(\dfrac{3 - 2}{2}\ ,\ \dfrac{-2 - 4}{2}\right) = (1/2\ ,\ -3)$

28F

1) $-5[D + N = 27] \qquad -5D - 5N = -135$

$100[.10D + .05N = 2.05] \qquad 10D + 5N = 205$

$5D = 70 \qquad D = 14$

2) $N = 13$

check: $14(.10) + 13\ (.05) = 1.40 + .65 = 2.05$

3) $N, N + 1, N + 2$

$6(N + 2) - (N + 1) = 4N$

$6N + 12 - N - 1 = 4N$

$5N + 11 = 4N \qquad N = -11$

4) $-11, -10, -9$

check: $6(-9) - (-10) = 4(-11) \qquad -44 = -44$

5) $N, N + 2, N + 4$

$5(N + 4) = 7(N + 2) - 6$

$5N + 20 = 7N + 8$

$12 = 2N \qquad N = 6$

6) 6, 8, 10

check: $5(10) = 7(8) - 6 \qquad 50 = 50$

7) $N, N + 2, N + 4$

$4(N) + 3(N + 4) = 5(N + 2)$

$4N + 3N + 12 = 5N + 10$

$7N + 12 = 5N + 10$

$2N = -2 \qquad N = -1$

8) $-1, 1, 3$

check: $4(-1) + 3(3) = 5(1) \qquad 5 = 5$

9) $G_S = 75\%, \ G_F = 40\%, \ G_{FF} = 55\%$

$[G_S + G_F = 28] \times (-40) \qquad -40G_S - 40G_F = -1120$

$[.75G_S + .40G_F = .55(28)] \times (100) \qquad 75G_S + 40G_F = 1540$

$35G_S = 420$

$G_S = 12$ oz.

10) $G_{40\%} = 16$ oz. $\quad (G_S + G_F = 28)$

11) $W_T = 25\%, \ W_S = 60\%, \ W_F = 45\%$

$[W_T + W_S = 28] \times (-25) \qquad -25W_T - 25W_S = -700$

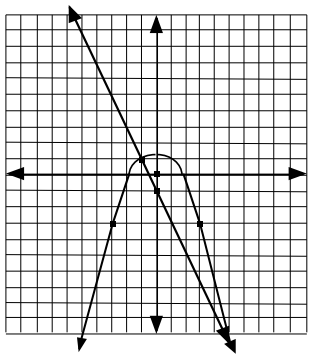
$[.25W_T + .60W_S = .45(28)] \times (100) \qquad 25W_T + 60W_S = 1260$

$35W_S = 560$

$W_S = 16, \quad W_T = 12$ okay

12) $W_S = 16, \ W_T = 12$

#14



13) line and parabola

14) on the graph

15) $2(-2X - 1) = -X^2 + 3$

substitution

16) $-4X - 2 = -X^2 + 3$

$X^2 - 4X - 5 = 0$

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

$X = 5, -1$

17) $Y = -2(5) - 1 \qquad Y = -2(-1) - 1$

$Y = -11 \qquad Y = 1$

18) (5, -11) (-1, 1)

29F

1) $(F + 10) = 1/2 (J + 10)$
$2(F + 10) = J + 10$
$2F + 20 = J + 10$
$2F + 10 = J$

2) $(J - 10) = 6(F - 10)$

3) $[(2F + 10) - 10] = 6(F - 10)$
$2F = 6F - 60$
$-4F = -60$
$F = 15$

4) $2F + 10 = J$
$2(15) + 10 = J$
$40 = J$

5) $B = 1/6\ D$ or $6B = D$

6) $(D + 4) = 4(B + 4)$

7) $(6B) + 4 = 4(B + 4)$
$6B + 4 = 4B + 16$
$2B = 12$
$B = 6$

8) $6B = D$
$6(6) = D$
$D = 36$

9) $D_D = R_D \times T_D \qquad 21 = R_D \times 3$
$R_D = 7 = B + W$

10) $D_U = R_U \times T_U \qquad 21 = R_U \times 7$
$R_U = 3 = B - W$

11) $B + W = 7$
$B - W = 3$
$2B = 10$
$B = 5$

12) $7 = B + W$
$7 = (5) + W$
$2 = W$

13) $-25[Q + H = 13] \qquad -25Q - 25H = -325$
$100[.25Q + .50H = 4.75] \qquad 25Q + 50H = 475$
$25H = 150$
$H = 6$

14) $(Q + H = 13), \qquad Q = 7$
check: $6(.50) + 7(.25) = 4.75$
$4.75 + 4.75$

15) $-9(N + 2) - 12 = 2(N + 1) - 7(N)$
$-9N - 18 - 12 = 2N + 2 - 7N$
$-9N - 30 = -5N + 2$
$-4N = 32$
$N = -8$

16) $-8, -7, -6$
check: $-9(-6) - 12 = 2(-7) - 7(-8)$
$42 = 42$

17) $4(N + 2) + 10 = 3(N) + 2(N + 4)$
$4N + 8 + 10 = 5N + 8$
$10 = N$

18) $10, 12, 14$
check: $4(12) + 10 = 3(10) + 2(14)$
$58 = 58$

19) $P_S = 60\%, P_T = 10\%$
$-10[P_S + P_T = 16] \qquad -10P_S - 10P_T = -160$
$100[.60P_S + .10P_T = .40(16)] \qquad 60P_S + 10P_T = 640$
$50P_S = 480$
$P_S = 9.6$ oz.

20) $P_T = 6.4$ oz., $9.6 + 6.4 = 16$ oz.

30F

Numbers 1-6

A. $X + 2Y + 6Z = 7$
B. $4X - 5Y - 2Z = -11$
C. $-X - 6Y - 3Z = 14$

$A + B = D$

A. $[X + 2Y + 6Z = 7] \times (1)$ $\quad X + 2Y + 6Z = 7$
B. $[4X - 5Y - 2Z = -11] \times (3)$ $\quad 12X - 15Y - 6Z = -33$

Eliminate Z

D $\quad 13X - 13Y = -26$

Eliminate X

$(\div 13)\ X - Y = -2$
$(x1)\ -X - 10Y = 35$
$-11Y = 33$
$Y = -3$

$A + C = E$

A. $[X + 2Y + 6Z = 7] \times (1)$ $\quad X + 2Y + 6Z = 7$
C. $[-X - 6Y - 3Z = 14] \times (2)$ $\quad -2X - 12Y - 6Z = 28$

E $\quad -X - 10Y = 35$

Put Y=-3 in D.

D $X - (-3) = -2$
$X + 3 = -2$
$X = -5$

Put Y=-3 & X=-5 in A.

A $(-5) + 2(-3) + 6Z = 7$
$-11 + 6Z = 7$
$6Z = 18$
$Z = 3$

Numbers 7-12

A. $3X + Y + 2Z = 4$
B. $-X + 5Y + 3Z = -5$
C. $6X - 2Y + 3Z = 9$

$A + B = D$

A. $[3X + Y + 2Z = 4] \times (1)$ $\quad 3X + Y + 2Z = 4$
B. $[-X + 5Y + 3Z = -5] \times (3)$ $\quad -3X + 15Y + 9Z = -15$

Eliminate X

D $\quad 16Y + 11Z = -11$

Eliminate X

$(x1)\ 16Y + 11Z = -11$
$(x4)\ -16Y - 4Z = 4$
$7Z = -7$
$Z = -1$

$A + C = E$

A. $[3X + Y + 2Z = 4] \times (-2)$ $\quad -6X - 2Y - 4Z = -8$
C. $[6X - 2Y + 3Z = 9] \times (1)$ $\quad 6X - 2Y + 3Z = 9$

E $\quad -4Y - Z = 1$

Put Z=-1 in D.

D $16Y + 11(-1) = -11$
$16Y = 0$
$Y = 0$

Put Z=-1 & Y=0 in A.

A $3X + (0) + 2(-1) = 4$
$3X - 2 = 4$
$3X = 6$
$X = 2$

Numbers 13-16

$(D + 2) = 2(B + 2) \quad = \quad D = (2B + 4) - 2 \qquad D = 2B + 2$

$(D - 8) = 2.5(B - 8) \quad = \quad D = (2.5B - 20) + 8 \qquad D = 2.5B - 12$

$2B + 2 = 2.5B - 12$

$14 = .5B$ so $B = 28$ and $D = 2(28) + 2 = 58$ $\quad D = 58$

Numbers 17-20

$D_D = R_D T_D = 70 = R_D (5)$

$R_D = 14 = B + W$

$D_U = R_U T_U = 20 = R_U (5)$

$R_U = 4 = B - W$

$18 = 2B \qquad B = 9 \qquad 14 = 9 + W \qquad W = 5$

31F-1

Numbers 1-3

$-3X + Y = -1$

$3X + 4Y = -19$

$$X = \frac{\begin{vmatrix} -1 & 1 \\ -19 & 4 \end{vmatrix}}{\begin{vmatrix} -3 & 1 \\ 3 & 4 \end{vmatrix}} = \frac{-4+19}{-12-3} = \frac{15}{-15} = -1 \qquad Y = \frac{\begin{vmatrix} -3 & -1 \\ 3 & -19 \end{vmatrix}}{\begin{vmatrix} -3 & 1 \\ 3 & 4 \end{vmatrix}} = \frac{57+3}{-12-3} = \frac{60}{-15} = -4$$

Check

$-3(-1) + (-4) = -1$

$-1 = -1\ \surd$

$3(-1) + 4(-4) = -19$

$-19 = -19\ \surd$

Numbers 4-6

$-2X + Y = 2$

$4X + Y = -4$

$$X = \frac{\begin{vmatrix} 2 & 1 \\ -4 & 1 \end{vmatrix}}{\begin{vmatrix} -2 & 1 \\ 4 & 1 \end{vmatrix}} = \frac{2+4}{-2-4} = \frac{6}{-6} = -1 \qquad Y = \frac{\begin{vmatrix} -2 & 2 \\ 4 & -4 \end{vmatrix}}{\begin{vmatrix} -2 & 1 \\ 4 & 1 \end{vmatrix}} = \frac{8-8}{-2-4} = \frac{0}{-6} = 0$$

Check

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

$2 = 2\ \surd$

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

$-4 = -4\ \surd$

Numbers 7-9

$-4X + 3Y = 2$

$-2X + Y = -6$

$$X = \frac{\begin{vmatrix} 2 & 3 \\ -6 & 1 \end{vmatrix}}{\begin{vmatrix} -4 & 3 \\ -2 & 1 \end{vmatrix}} = \frac{2-(-18)}{-4-(-6)} = \frac{20}{2} = 10 \qquad Y = \frac{\begin{vmatrix} -4 & 2 \\ -2 & -6 \end{vmatrix}}{\begin{vmatrix} -4 & 3 \\ -2 & 1 \end{vmatrix}} = \frac{24-(-4)}{-4-(-6)} = \frac{28}{2} = 14$$

Check

$-4(10) + 3(14) = 2$

$2 = 2\surd$

$-2(10) + (14) = -6$

$-6 = -6\surd$

Numbers 10-13

A. $X + 2Y + 6Z = 7$

B. $4X - 5Y - 2Z = -11$

C. $-X - 6Y - 3Z = 14$

$$X = \frac{\begin{vmatrix} 7 & 2 & 6 \\ -11 & -5 & -2 \\ 14 & -6 & -3 \end{vmatrix} \begin{matrix} 7 & 2 \\ -11 & -5 \\ 14 & -6 \end{matrix}}{\begin{vmatrix} 1 & 2 & 6 \\ 4 & -5 & -2 \\ -1 & -6 & -3 \end{vmatrix} \begin{matrix} 1 & 2 \\ 4 & -5 \\ -1 & -6 \end{matrix}} = \frac{(7)(-5)(-3)+(2)(-2)(14)+(6)(-11)(-6)-(14)(-5)(6)-(-6)(-2)(7)-(-3)(-11)(2)}{(1)(-5)(-3)+(2)(-2)(-1)+(6)(4)(-6)-(-1)(-5)(6)-(-6)(-2)(1)-(-3)(4)(2)}$$

$$= \frac{(105)+(-56)+(396)-(-420)-(84)-(66)}{(15)+(4)+(-144)-(30)-(12)-(-24)} = \frac{715}{-143} = -5$$

$$Y = \frac{\begin{vmatrix} 1 & 7 & 6 \\ 4 & -11 & -2 \\ -1 & 14 & -3 \end{vmatrix} \begin{matrix} 1 & 7 \\ 4 & -11 \\ -1 & 14 \end{matrix}}{\begin{vmatrix} 1 & 2 & 6 \\ 4 & -5 & -2 \\ -1 & -6 & -3 \end{vmatrix} \begin{matrix} 1 & 2 \\ 4 & -5 \\ -1 & -6 \end{matrix}} = \frac{(1)(-11)(-3)+(7)(-2)(-1)+(6)(4)(14)-(-1)(-11)(6)-(14)(-2)(1)-(-3)(4)(7)}{(1)(-5)(-3)+(2)(-2)(-1)+(6)(4)(-6)-(-1)(-5)(6)-(-6)(-2)(1)-(-3)(4)(2)}$$

$$= \frac{(33)+(14)+(336)-(66)-(-28)-(-84)}{(15)+(4)+(-144)-(30)-(12)-(-24)} = \frac{429}{-143} = -3$$

31F-2

$$Z = \frac{\begin{vmatrix} 1 & 2 & 7 & 1 & 2 \\ 4 & -5 & -11 & 4 & -5 \\ -1 & -6 & 14 & -1 & -6 \end{vmatrix}}{\begin{vmatrix} 1 & 2 & 6 & 1 & 2 \\ 4 & -5 & -2 & 4 & -5 \\ -1 & -6 & -3 & -1 & -6 \end{vmatrix}} = \frac{(1)(-5)(14)+(2)(-11)(-1)+(7)(4)(-6)-(-1)(-5)(7)-(-6)(-11)(1)-(14)(4)(2)}{(1)(-5)(-3)+(2)(-2)(-1)+(6)(4)(-6)-(-1)(-5)(6)-(-6)(-2)(1)-(-3)(4)(2)}$$

$$= \frac{(-70)+(22)+(-168)-(35)-(66)-(112)}{(15)+(4)+(-144)-(30)-(12)-(-24)} = \frac{-429}{-143} = 3$$

(X, Y, Z) = (-5, -3, 3)

Numbers 14-17

A. $3X + Y + 2Z = 4$

B. $-X + 5Y + 3Z = -5$

C. $6X - 2Y + 3Z = 9$

$$X = \frac{\begin{vmatrix} 4 & 1 & 2 & 4 & 1 \\ -5 & 5 & 3 & -5 & 5 \\ 9 & -2 & 3 & 9 & -2 \end{vmatrix}}{\begin{vmatrix} 3 & 1 & 2 & 3 & 1 \\ -1 & 5 & 3 & -1 & 5 \\ 6 & -2 & 3 & 6 & -2 \end{vmatrix}} = \frac{(4)(5)(3)+(1)(3)(9)+(2)(-5)(-2)-(9)(5)(2)-(-2)(3)(4)-(3)(-5)(1)}{(3)(5)(3)+(1)(3)(6)+(2)(-1)(-2)-(6)(5)(2)-(-2)(3)(3)-(3)(-1)(1)}$$

$$= \frac{(60)+(27)+(20)-(90)-(-24)-(-15)}{(45)+(18)+(4)-(60)-(-18)-(-3)} = \frac{56}{28} = 2$$

$$Y = \frac{\begin{vmatrix} 3 & 4 & 2 & 3 & 4 \\ -1 & -5 & 3 & -1 & -5 \\ 6 & 9 & 3 & 6 & 9 \end{vmatrix}}{\begin{vmatrix} 3 & 1 & 2 & 3 & 1 \\ -1 & 5 & 3 & -1 & 5 \\ 6 & -2 & 3 & 6 & -2 \end{vmatrix}} = \frac{(3)(-5)(3)+(4)(3)(6)+(2)(-1)(9)-(6)(-5)(2)-(9)(3)(3)-(3)(-1)(4)}{(3)(5)(3)+(1)(3)(6)+(2)(-1)(-2)-(6)(5)(2)-(-2)(3)(3)-(3)(-1)(1)}$$

$$= \frac{(-45)+(72)+(-18)-(-60)-(81)-(-12)}{(45)+(18)+(4)-(60)-(-18)-(-3)} = \frac{0}{28} = 0$$

$$Z = \frac{\begin{vmatrix} 3 & 1 & 4 & 3 & 1 \\ -1 & 5 & -5 & -1 & 5 \\ 6 & -2 & 9 & 6 & -2 \end{vmatrix}}{\begin{vmatrix} 3 & 1 & 2 & 3 & 1 \\ -1 & 5 & 3 & -1 & 5 \\ 6 & -2 & 3 & 6 & -2 \end{vmatrix}} = \frac{(3)(5)(9)+(1)(-5)(6)+(4)(-1)(-2)-(6)(5)(4)-(-2)(-5)(3)-(9)(-1)(1)}{(3)(5)(3)+(1)(3)(6)+(2)(-1)(-2)-(6)(5)(2)-(-2)(3)(3)-(3)(-1)(1)}$$

$$= \frac{(135)+(-30)+(8)-(120)-(30)-(-9)}{(45)+(18)+(4)-(60)-(-18)-(-3)} = \frac{-28}{28} = -1$$

(X, Y, Z) = (2, 0, -1)