1.1

$$\frac{y^{58}}{y^4 \cdot y^{12}} = \frac{y^{58}}{y^{16}} = \underline{\underline{y^{42}}}$$

1.2

$$(2^3)^2 \cdot 2^x = 2^9$$
$$2^6 \cdot 2^x = 2^9$$
$$6+x=9$$
$$\underline{\underline{x=3}}$$

1.3

$y=\frac{x}{3}$

$x=3y$

$$x^{-2}y^2 = \frac{y^2}{x^2} = \frac{y^2}{(3y)^2} = \frac{y^2}{9y^2} = \underline{\underline{\frac{1}{9}}}$$

1.4

$$\frac{(2^{13})^{1/2}}{((2^3)^3)^{1/2}} = \frac{2^{6.5}}{2^{4.5}} = 2^2 = \underline{\underline{4}}$$

1.5 (a) T (b) T (c) T (d) T

1.6

$$\frac{(x+5)\cancel{(x-5)}}{\cancel{(x-5)}} = 3$$
$$x+5=3$$
$$\underline{\underline{x=2}}$$

2.1

$K = C + 273.15$

$C = K - 273.15$

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

$\boxed{K = F}$

$K - 273.15 = \frac{5}{9}(K - 32$

$4/9\,K = 255.4$

$F = K = \underline{\underline{574.6}}$

2.2

$f(x) = 2y + 3 = 17$

$2y = 14$

$\underline{\underline{y = 7}}$

2.3

$3^{2x^2 - 4x + 3} = 3^3$

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

$2x^2 - 4x = 0$

$2x(x - 2) = 0$

$\underline{\underline{x_1 = 0}} \quad \underline{\underline{x_2 = 2}}$

2.5

$\ln\left(\frac{e^2}{e^3}\right) = \ln(e^{-1}) = \underline{\underline{-1}}$

3.1

$$\sum_{i=0}^{\infty}\left(\frac{1}{6^i}\right) + \sum_{i=0}^{\infty} 0.25^i$$

$$= \frac{6}{5} + \frac{4}{3} = \frac{38}{15}$$

3.2

$$\lim_{x\to 3} \frac{(x+3)\cancel{(x-3)}}{\cancel{(x-3)}}$$

$$\lim_{x\to 3} (3)+3 = 9$$

3.3

$f(x) = x^3-4$ at $(-1,-5)$

$y = x^3-4$ $\quad (0,-4)$

$$\frac{-5+4}{-1-0} = 1$$

3.4

$$\frac{d}{dx} = \frac{2x(x+2)-(x^2+3)}{(x+2)^2} = \frac{x^2+4x-3}{(x+2)^2}$$

3.5

$f'(x) = 7x^6+8x$

$f''(x) = 42x^5+8$

3.6 $f(x) = \frac{x^4 + 4^x}{\ln(x)}$

$$f'(x) = \frac{(4x^3 + 4^x \ln(4))\ln(x) - \frac{1}{x}(x^4 - 4^x)}{\ln(x)^2}$$

$$= \frac{\ln(x)[4x^3 + 4^x \ln(4)] - x^3 + \frac{4^x}{x}}{\ln(x)^2}$$

3.7 $f(x) = 3x^3 - 9x$

$f'(x) = 9x^2 - 9 = 0$

$x^2 = 1$

(local minimum) $x_1 = \pm 1$ $\quad$ $x_2 = -1$ (local maximum)

$y_1 = -6$ $\quad$ $y_2 = +6$

3.8

$f(2,3) = (2)^2 + 2(3)^3$

$= 4 + 54 = \underline{\underline{58}}$

3.9 $\frac{\partial f(x,y)}{\partial x} = \frac{2}{2x-y} = 2\left(\frac{1}{2x-y}\right) = 0$

$\frac{\partial f(x,y)}{\partial y} = \frac{-1}{2x-y} = -1\left(\frac{1}{2x-y}\right) = 0$

$0 < 2x - y \cancel{<} 2$

$2\left(\frac{1}{2x-y}\right) = -1\left(\frac{1}{2x-y}\right)$

$2(2x-y) = -(2x-y)$

$4x - 2y = -2x + y$

$\boxed{2x = y}$

3.10

$$\frac{\partial f(x,y)}{\partial x} = 5x^4e^y + 2xy^3$$

$$\frac{\partial f(x,y)}{\partial y} = x^5e^y + x^2 \cdot 3y^2$$

3.11

$$\frac{\partial f(x,y)}{\partial x} = \frac{y}{2\sqrt{xy}} - 0.7$$

$$\frac{\partial f(x,y)}{\partial y} = \frac{x}{2\sqrt{xy}} - 0.7$$

$$\frac{y}{2\sqrt{\cancel{xy}}} \cancel{-0.7} = \frac{x}{2\sqrt{\cancel{xy}}} \cancel{-0.7}$$

$$\boxed{y = x}$$

$$\frac{y}{2\sqrt{y^2}} - 0.7 = \frac{\cancel{y}}{2\cancel{y}} - 0.7 = \frac{1}{2} - 0.7 = \underline{\underline{-0.2}}$$

y (local min)

$\underline{\underline{x = -0.2}}$

3.12

$$\mathcal{L} = x^2y^2 - \lambda(x+y-10)$$

$$\frac{\partial \mathcal{L}}{\partial x} = 2xy^2 - \lambda = 0 \quad \boxed{2xy^2 = \lambda}$$

$$\frac{\partial \mathcal{L}}{\partial y} = 2x^2y - \lambda = 0 \quad \boxed{2x^2y = \lambda}$$

$$\cancel{2}\cancel{x}y^2 = \cancel{2}x^2\cancel{y}$$

$$\boxed{y = x}$$

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

$$2x = 10$$

$$\underline{\underline{x = 5}} \quad \underline{\underline{y = 5}}$$

4.1

$$\begin{array}{cc|ccc} & & 1 & 4 & 1 \\ & & 2 & 1 & 2 \\ \hline 2 & 3 & 8 & 11 & 8 \\ 4 & 1 & 6 & 17 & 6 \\ 1 & 2 & 5 & 6 & 5 \end{array}$$

$$\underline{A} \cdot \underline{B} = \begin{bmatrix} 8 & 11 & 8 \\ 6 & 17 & 6 \\ 5 & 6 & 5 \end{bmatrix}$$

4.2

$2 \times 3 \cdot 3 \times 2$

2×2

$$\underline{B} \cdot \underline{A} = \begin{bmatrix} 19 & 9 \\ 10 & 11 \end{bmatrix}$$

4.3

$$\begin{bmatrix} 3.3 & 6.1 & 45.76 \\ 5.1 & 1.23 & 0 \end{bmatrix}$$

4.4

$$\begin{matrix} 2 & 3 & 0 & 2 & 3 \\ 4 & 5 & 2 & 4 & 5 \\ 2 & 5 & 3 & 2 & 5 \end{matrix}$$

$$\det = 2.5.3 + 3.2.2 + 0.4.5 - 0.5.2 - 2.2.5 - 3.4.3$$
$$= \underline{\underline{-14}}$$

5.1 $2^2 = 4$ outcomes

$\Omega = \{(H,H),(H,T),(T,H),(T,T)\}$

5.2 $n = 30$ $\quad \# P_k^n = \frac{30!}{27!} = \underline{\underline{24{,}360}}$

$k = 3$

5.3 $A = \{(1,2),(1,4),(1,6),(2,1),(2,3),(2,5),(3,2),$
$(3,4),(3,6),(4,1),(4,3),(4,5),(5,2),$
$(5,4),(5,6),(6,1),(6,3),(6,5)\}$

$\# A = 18$

$P(A) = \frac{18}{36} = \underline{\underline{1/2}}$