

Elementary algebra

$$1.1) \frac{x^{n+2}}{x^{n-2}} = \frac{x^{n+2+4}}{x^{n-2}} = \frac{x^4}{1} //$$

$$\begin{aligned} 1.2) \quad x^{-1} \cdot 8 &= 2 \\ x^{-1} (2)^3 &= 2 \\ x^{-1} &= 2/2^3 \\ x^{-1} &= 1/4 \\ x &= 4 // \end{aligned}$$

$$1.3) \quad a = 5 \quad b = 6 \quad (a^b)^0 = ?$$

$$(5^{10})^0 = 0 //$$

$$1.4) \quad \frac{\sqrt{4x}}{\sqrt{x}} = \frac{2\sqrt{x}}{\sqrt{x}} = 2$$

$$1.5) \quad x^2 + (x+1)^2 = (x+2)^2$$

$$x^2 + x^2 + 2x + 1 = x^2 + 4x + 4$$

$$x^2 - 2x - 3 = 0$$

$$(x+1) \cdot (x-3) = 0$$

$$x_1 = -1$$

$$x_2 = 3$$

$$\begin{array}{r} 1.6) \quad 2^x \overline{) 71024} \\ \underline{2^x \overline{) 710}} \\ x \overline{) 710} // \end{array}$$

② Functions of one variable

2.1)	$^{\circ}\text{C}$	0	100	100
	$^{\circ}\text{F}$	32	212	180

$$y = 32 + 1.8x$$

$$32 + 1.8x = x$$

$$32 = -0.8x$$

$$x = (-40)$$

2.2) $f(x) = 5x + 4$ Find y if $f(x) = y$

$$f(x) = 5x + 4$$

$$f(3) = 5 \cdot 3 + 4$$

$$f(x) = 15 + 4$$

$$f(x) = 19 //$$

2.3) $x^2 - 4x + 3 = 0$ \rightarrow find all the values of x

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

$$(x-1)(x-3) = 0$$

$$x_1 = 1$$

$$x_2 = 3 //$$

2.4) $10 \cdot (1.02)^{10} = 59.43$ \rightarrow compound interest

2.5) $e^{\ln 5}$
 $e^{\ln 5} = 5$

Calculus

$$3.1) \sum_{i=1}^{\infty} \frac{12}{6^i} = a_n = 12 (1/6^i) \quad a=12 \quad b=1/6$$

$$\sum_{i=1}^{\infty} \frac{12}{6^i} = \frac{12(1/6)}{1-1/6} = \frac{2}{5/6} = \frac{6 \cdot 2}{5} = \frac{12}{5}$$

$$3.2) \lim_{x \rightarrow 1} \frac{6^{1-x}}{x} = \frac{6^{1-x} \cdot 6^x}{x \cdot 6^x} = \frac{6}{x \cdot 6^x} \quad \frac{6}{1 \cdot 6} = \frac{6}{6} = 1$$

$$3.3) f(x) = x^5 - 8 \quad \text{at } x = -3$$

$$f(x) = x^5 - 8$$

$$= 5x^4$$

$$f(-3) = 5(-3)^4$$

$$= 405$$

$$3.4) \frac{d}{dx} \frac{x^3 + 2x - 1}{x - 2} = \frac{(3x^2 + 2)(x - 2) - (x^3 + 2x - 1) \cdot 1}{(x - 2)^2}$$

$$= \frac{3x^3 - 6x^2 + 2x - 4 - x^3 - 2x + 1}{x^2 - 4x + 4}$$

$$= \frac{2x^3 - 6x^2 - 7}{x^2 - 4x + 4}$$

$$3.5) \frac{d^2}{dx^2} 4x^4 + 4x^2$$

$$d_1 = 16x^3 + 8x$$

$$d_2 = 48x^2 + 8$$

$$3.6) \frac{d}{dx} \cdot \frac{\ln x}{e^x}$$

$$= \frac{1/x \cdot e^x - \ln x \cdot e^x}{(e^x)^2} = \frac{1/x - \ln x}{e^x}$$

$$3.7) \cdot p(x) = 3x^2 - 5x + 2$$

$$d_1 = 6x - 5$$

$$d_2 = 6 \rightarrow \text{local minimum}$$

$$6x - 5 = 0$$

$$6x = 5$$

$$x = 5/6 \rightarrow \text{static point}$$

	$x = 5/6$	$5/6$	$5/6, 5/6$
$f(x)$	\nwarrow	loc min	\nearrow
$f'(x)$	-	0	+
$f''(x)$	+	+	+

$$3.8) f(x, y) = x^2 y^3$$

$$\begin{aligned} f(2, 3) &= 2^2 + 3^3 \\ &= 4 + 27 \\ &= 31 // \end{aligned}$$

$$\begin{aligned} 3.9) f(x, y) &= \ln(x \cdot y) \\ &= (x \cdot y) > 0 \\ &x > y \end{aligned}$$

$$3.10) \frac{\partial}{\partial x} x^5 + xy^3 \Rightarrow 5x^4 + y^3 //$$

$$3.11) f(x, y) = x^2 y^2 + 10$$

$$f'_x = 2xy^2$$

$$f''_x = 2y^2$$

$$f'_y = x^2 2y$$

$$f''_y = x^2 \cdot 2$$

$$f'_x = 2xy^2 \quad x=0$$

$$\Rightarrow 2(0)^2 = 0 // \rightarrow \text{local minima}$$

$$f'_y = x^2 2y \quad y=0$$

$$2x^2 \cdot 2(0) = 0 //$$

$$\rightarrow \text{local minima}$$

3.12) $\max x^2 y^2$ s.t. $x+y=10$

$$\begin{cases} 2xy^2 - \lambda = 0 \\ 2yx^2 - \lambda = 0 \end{cases} \Rightarrow \begin{cases} 2xy^2 = 2yx^2 \\ x=y \end{cases}$$

$$\begin{cases} x+y=10=0 \\ x=y \end{cases} \Rightarrow \begin{cases} x+y=10 \\ x=y=5 \end{cases}$$

Linear algebra

4.1) $\begin{bmatrix} 1 & 1 & 7 \\ 2 & 8 & 2 \end{bmatrix}$

$\begin{bmatrix} 2 & 6 \\ 5 & 1 \\ 1 & 9 \end{bmatrix}$	$\begin{array}{l} 1(2) \\ 6(2) \\ \hline 1(5) \\ 2(1) \\ \hline 1(1) \\ 9(2) \end{array}$	$\begin{array}{l} 2(1) \\ 6(8) \\ \hline 5(1) \\ 8(1) \\ \hline 1(1) \\ 9(8) \end{array}$	$\begin{array}{l} 2(7) \\ 6(2) \\ \hline 5(7) \\ 1(2) \\ \hline 1(7) \\ 9(2) \end{array}$	$\begin{array}{l} 14 \quad 50 \quad 27 \\ 7 \quad 17 \quad 27 \\ 19 \quad 73 \quad 25 \end{array}$
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4.2)

$$\begin{bmatrix} 1 & 9 & 1 \\ 2 & 1 & 2 \end{bmatrix}$$

$\begin{array}{l} 2 \\ 4 \\ 1 \\ 1(2) \\ 9(4) \\ \hline 1(1) \\ 2(2) \\ 1(4) \\ 1(2) \end{array}$	$\begin{array}{l} 2 \\ 6 \\ 3 \\ 1(2) \\ 9(6) \\ \hline 1(3) \\ 2(2) \\ 1(6) \\ 2(3) \end{array}$	$\begin{array}{l} = 39 \\ = 10 \end{array}$	$\begin{array}{l} 59 \\ 14 \end{array}$
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$$4.3) \begin{bmatrix} 7.1 & 9.1 & 6.7 \\ 2 & 7.8 & 1.1 \\ 4 & 4.44 & 0 \end{bmatrix} = \begin{bmatrix} 7.1 & 2 & 4 \\ 9.1 & 7.8 & 4.44 \\ 4.7 & 1.1 & 0 \end{bmatrix}$$

$$4.4) \begin{bmatrix} 1 & 9 \\ 2 & 8 \end{bmatrix} \quad \begin{array}{r} 1.8 \\ -9.2 \\ \hline -10 \end{array}$$

5 Probability Theory

5.1)

d_i		1	2	3	4	5	6
d_1	1	11	21	31	41	51	61
	2	12	22	32	42	52	62
	3	13	23	33	43	53	63
	4	14	24	34	44	54	64
	5	15	25	35	45	55	65
	6	16	26	36	46	56	66

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5.2)

	Drug user	Drug	Test	
		+	-	
Y	(1%)	99%	1%	$\leq 1\% (99\%) + 99\% (.5\%)$
N	(99%)	.5%	99.5%	$= 140.5\%$

5.3)

	Drug user	Drug	Test	
		+	-	
Y		1, 99	1, .01	99%, .01%
N		99, .05	99, 99.5	.495%, 98.505%

$$\frac{.99}{.99 + .495} = \frac{1}{2} = 66.67\%$$