Chapter 1

① $\lim_{x\to 5} \frac{x^2-25}{x-5} = \lim_{x\to 5} \frac{(x-5)(x+5)}{(x-5)} = \lim_{x\to 5} x+5 = \boxed{10}$

② $f(x) = \frac{3x^2-x-2}{x-1} = \frac{(3x+2)(x-1)}{x-1} = 3x+2$ Removable Disc. @ $x=1$

③ $\lim_{x\to 2^-} \frac{1}{\sqrt[3]{x^2-4}} = \boxed{-\infty}$ (DNE)

④ a. $\lim_{x\to 0} f(x)$ $\boxed{DNE}$ b. $f(0) = \boxed{5}$ c. $\lim_{x\to -4} f(x) = \boxed{2}$

d. $f(-4) = \boxed{0}$ e. $\lim_{x\to -2} f(x)$ $\boxed{DNE}$ $-\infty$

⑤ $\lim_{x\to 3} \sqrt{x^2-4} = \boxed{\sqrt{5}}$ ⑥ $\lim_{x\to 2^-} \frac{1}{x-2} = \boxed{-\infty}$ (DNE)

⑦ A discontinuity at c is removable if the function can be made continuous by defining or redefining f(c); for example: A hole

A nonremovable discontinuity is one in which a function cannot be redefined to make it continuous, for example: VA or jump.

Chapter 1

① $f(x) = x^2 + 5x - 13$

$$\lim_{h\to 0} \frac{[(x+h)^2 + 5(x+h) - 13] - (x^2 + 5x - 13)}{h}$$

$$= \lim_{h\to 0} \frac{x^2 + 2xh + h^2 + 5x + 5h - 13 - x^2 - 5x - 13}{h} = \lim_{h\to 0} \frac{2xh + h^2 + 5h}{h}$$

$$= \lim_{h\to 0} 2x + h + 5 = \boxed{2x+5}$$

② $f(x) = 6\sqrt{x} - \frac{3}{2x^3} + \cos x$

$f(x) = 6x^{1/2} - \frac{3}{2}x^{-3} + \cos x$

$f'(x) = 3x^{-1/2} + \frac{9}{2}x^{-4} - \sin x$

$\boxed{f'(x) = \frac{3}{\sqrt{x}} + \frac{9}{2x^4} - \sin x}$

③ $f(x) = (2x^2 - 7)^5$

$f'(x) = 5(2x^2-7)^4(4x)$

$\boxed{f'(x) = 20x(2x^2-7)^4}$

④ $f(x) = 3x^2 \sec x$

$\boxed{f'(x) = 3x^2(\sec x \tan x) + 6x \sec x}$

⑤ $f(x) = \frac{\tan x}{x^2}$ $\quad f'(x) = \frac{x^2 \sec^2 x - 2x \tan x}{x^4}$

$\boxed{f'(x) = \frac{x\sec^2 x - 2\tan x}{x^3}}$

⑥ $f(x) = 2x^2 + \sin^2(2x)$

$f'(x) = 4x + 2(\sin(2x))(\cos 2x)(2)$

$\boxed{f'(x) = 4x + 4\sin 2x \cos 2x}$

✓ (7.) $x^2 + 3xy + y^3 = 10$

$2x + 3x\left(\frac{dy}{dx}\right) + 3y + 3y^2\left(\frac{dy}{dx}\right) = 0$

$(3x + 3y^2)\frac{dy}{dx} = -2x - 3y$

$\boxed{\frac{dy}{dx} = \frac{-2x-3y}{3x+3y^2}}$

✓ (8.) $f(x) = \frac{2}{3}x^2 - \frac{1}{6}x \quad \left(-1, \frac{5}{6}\right)$

$f'(x) = \frac{4}{3}x - \frac{1}{6}$

$f'(-1) = -\frac{4}{3} - \frac{1}{6} = -\frac{3}{2}$

$\boxed{y - \frac{5}{6} = -\frac{3}{2}(x+1)}$

✓ (9) $V_0 = 0$

$a(t) = -32 \text{ ft/sec}$

$v(t) = -32t$

$s(t) = -16t^2 + h$

$0 = -16(9.2)^2 + h$

$\boxed{1354.24 \text{ ft} = h}$

(10) $SA = 6x^2$

$\frac{ds}{dt} = 12x\left(\frac{dx}{dt}\right)$

$\frac{ds}{dt} = 12(4.5)(5) = \boxed{270 \text{ cm/sec}}$

✓ (11) $f(x) = \frac{x+1}{x-1} \quad \left(\frac{1}{2}, -3\right)$

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

$f'\left(\frac{1}{2}\right) = 8$

$\boxed{y + 3 = 8\left(x - \frac{1}{2}\right)}$

✓ (12) $f(x) = \sqrt[3]{1-x^3}$

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

$\boxed{f'(x) = \frac{-x^2}{(1-x^3)^{2/3}}}$

✓ (13.) $v(t) = \frac{90t}{4t+10}$

$v'(t) = \frac{(4t+10)(90) - 90t(4)}{(4t+10)^2}$

$v'(5) = \frac{30(90) - 1800}{(30)^2}$

$\boxed{v'(5) = 1 \text{ ft/sec}^2}$

✓ (14.) $y = 1 - \cos(2x) + 2\cos^2 x$

$\boxed{\frac{dy}{dx} = 2\sin(2x) - 4\cos x \sin x}$

✓ (15) $x^2 + y^2 = 20 \quad (2, 4)$

$2x + 2y\frac{dy}{dx} = 0$

$\frac{dy}{dx} = \frac{-x}{y}$ @ $(2,4)$ $= -\frac{1}{2}$

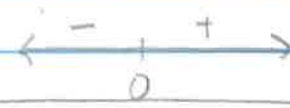
$\boxed{y - 4 = -\frac{1}{2}(x-2)}$

Chapter 3

(1) $f(x) = x^3 - 12x$ $\qquad f'(x) = 3x^2 - 12$ $\qquad f''(x) = 6x$

$0 = 3x^2 - 12$ $\qquad 0 = 6x$

$x = \pm 2$ $\qquad x = 0$



Rel Max $(-2, 16)$ Rel Min $(2, -16)$ $\qquad$ CU: $(0, \infty)$ CD: $(-\infty, 0)$

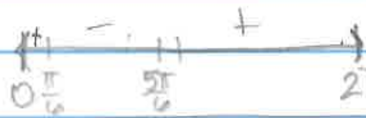
Inc: $(-\infty, -2) \cup (2, \infty)$ Dec: $(-2, 2)$ $\qquad$ POI $(0, 0)$

(2.) $f(x) = 4x + 8\cos x$ $\qquad f'(x) = 4 - 8\sin x$ $\qquad f''(x) = -8\cos x$

$f(\frac{\pi}{6}) = \frac{2\pi}{3} + 8(\frac{\sqrt{3}}{2})$ $\qquad 0 = 4 - 8\sin x$ $\qquad -8\cos x = 0$

$f(\frac{5\pi}{6}) = \frac{10\pi}{3} - 8(\frac{\sqrt{3}}{2})$ $\qquad \sin x = \frac{1}{2}$ $\qquad \cos x = 0$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$ $\qquad x = \frac{\pi}{2}, \frac{3\pi}{2}$



Rel Max $(\frac{\pi}{6}, \frac{2\pi}{3} + 4\sqrt{3})$ Rel Min $(\frac{5\pi}{6}, \frac{10\pi}{3} - 4\sqrt{3})$ $\qquad$ CU: $(\frac{\pi}{2}, \frac{3\pi}{2})$ CD: $(0, \frac{\pi}{2}) \cup (\frac{3\pi}{2}, 2\pi)$

Inc $(0, \frac{\pi}{6}) \cup (\frac{5\pi}{6}, 2\pi)$ $\qquad$ POI $(\frac{\pi}{2}, 2\pi)$ + $(\frac{3\pi}{2}, 6\pi)$.

(3) $f'(x) = 2x + 2$

$x = -1$

$f(x) = x^2 + 2x$

x	y=f(x)
-2	0
-1	1-2=-1
4	24

Abs Min $(-1, -1)$

Abs Max $(4, 24)$

(4) $\lim_{x \to \infty} \frac{-2x^3 - 6x + 1}{3x^2 - 2} = -\infty$ $\qquad$ (5) $\lim_{x \to \infty} \frac{x^2 + x^3}{x^2 - 3} = \infty$ $\qquad$ (6) $\lim_{x \to \infty} \frac{-4x^2 + x + 1}{x^3 - 2} = 0$

✓ (7) $f(x) = 2x^2 - 3x + 1$ $\qquad (0, 1)\ (4, 21)$ $\qquad m = \frac{20}{4} = 5$

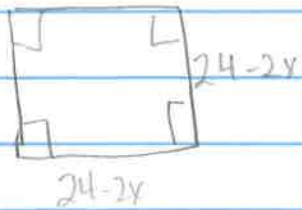
$f'(x) = 4x - 3$ $\qquad 4x - 3 = 5$

$4x = 8$ $\qquad \boxed{c = 2}$

$x = 2$

(8.) f(x) is defined at $x=3$, increasing, and concave down

✓ (9.)



$V = x(24-2x)(24-2x)$

$V = x(576 - 48x - 4x^2)$

$V = 576x - 48x^2 - 4x^3$

$\frac{dV}{dx} = 576 - 96x - 12x^2$

$x = \frac{96 \pm \sqrt{9216 - 4(-12)(576)}}{2(-12)}$

$x = \frac{96 \pm 192}{-24} = 4 \text{ or } \cancel{-12}$

$x = 4 \qquad \text{Max } V = \boxed{1024 \text{ in}^3}$

(10) $f(x) = 3x^2 + 2x + 1$

$f'(x) = 6x + 2$

$\boxed{x = -\frac{1}{3}}$

$\boxed{\text{Chapter 4}}$

(1) $\int (5-x)\,dx = \boxed{5x - \frac{1}{2}x^2 + C}$

(2) $\frac{1}{9}\int x^2\sqrt{1-3x^3}$ $\qquad u = 1-3x^3$, $du = -9x^2\,dx$

$= -\frac{1}{9}\int u^{1/2}\,du$

$= -\frac{1}{9}\left[\frac{2}{3}u^{3/2}\right] + C$

$\boxed{= \frac{-2}{27}(1-3x^3)^{3/2} + C}$

(3) $\int (x^{3/4}+1)\,dx$

$\boxed{= \frac{4}{7}x^{7/4} + x + C}$

(4) $\int (x^2+3x^3)\,dx$

$\boxed{= \frac{1}{3}x^3 + \frac{3}{4}x^4 + C}$

(5) $\frac{1}{2}\int 2(2x-3)^3\,dx$ $\qquad u = 2x-3$, $du = 2\,dx$

$= \frac{1}{2}\int u^3\,du$

$= \frac{1}{2}\left(\frac{1}{4}u^4\right) + C$

$\boxed{= \frac{1}{8}(2x-3)^4 + C}$

(6) $-2\int -\frac{1}{2}\,2\cos^4 x)(\sin x)\,dx$

$u = \cos x$ $\qquad -2\int u^4\,du$

$du = -\sin x\,dx$ $\qquad = -2\left[\frac{1}{5}u^5\right] + C$

$\boxed{= -\frac{2}{5}\cos^5 x + C}$

(7) $-\left(\frac{2}{5}\right)$

$\frac{-5}{2}\int 5x(2-x^2)^8\,dx$

$u = 2-x^2$ $\qquad = -\frac{5}{2}\int u^8\,du$

$du = -2x\,dx$ $\qquad = \frac{-5}{2}\left(\frac{1}{9}u^9\right) + C$

$\boxed{= \frac{-5}{18}(2-x^2)^9 + C}$

(8) $\int (x^2 + \sec^2 x)\,dx$

$\boxed{= \frac{1}{3}x^3 + \tan x + C}$

(9) $\int (x^{-2} + 2 - 3x^{-4})$

$= -x^{-1} + 2x + x^{-3} + C$

$\boxed{= \frac{-1}{x} + 2x + \frac{1}{x^3} + C}$

(10) $\int_{-2}^{4} (3x-5)\,dx = \left[\frac{3}{2}x^2 - 5x\right]_{-2}^{4}$

$= 4 - 16 = \boxed{-12}$

x (11) $\int_1^3 (t^{-2} - t^{-4})\,dt = \left[-t^{-1} + \frac{1}{3}t^{-3}\right]_1^3$

$\left[\frac{-1}{t} + \frac{1}{3t^3}\right]_1^3 = \frac{-26}{81} + \frac{2}{3} = \boxed{\frac{28}{81}}$

$\boxed{\approx 0.3457}$

x (12) $\int_{\frac{\pi}{4}}^{\pi} \sec^2\theta\,d\theta$

$= [\tan\theta]_{\frac{\pi}{4}}^{\pi}$

$= \tan\pi - \tan\frac{\pi}{4}$

$0 - 1 = \boxed{-1}$

(13.) $\int_{\frac{\pi}{4}}^{\pi} (\cos\theta + 2\sin\theta)\,d\theta$

$= [\sin\theta - 2\cos\theta]_{\frac{\pi}{4}}^{\pi}$

$(0+2) - \left(\frac{\sqrt{2}}{2} - 2\left(\frac{\sqrt{2}}{2}\right)\right)$

$= 2 - \frac{\sqrt{2}}{2} + \sqrt{2}$

$= 2 + \frac{\sqrt{2}}{2} = \boxed{\frac{4+\sqrt{2}}{2}}$

(14) $f(x) = x^2 - 2x \quad [0,3]$

$\frac{1}{3}\int_0^3 (x^2 - 2x)\,dx$

$\frac{1}{3}\left[\frac{1}{3}x^3 - x^2\right]_0^3$

$\frac{1}{3}[0 - 0] = \boxed{0}$

(15) $f(x) = \sin x \quad [0,\pi]$

$\frac{1}{\pi}\int_0^{\pi} \sin x\,dx$

$\frac{1}{\pi}[-\cos x]_0^{\pi}$

$\frac{1}{\pi}(1+1) = \boxed{\frac{2}{\pi}}$

(16) $\int_{-0.5}^{1} \sqrt{1+x^3}\,dx = \frac{1}{2}\left(\frac{1}{2}\right)\left[f(-0.5) + 2f(0) + 2f(0.5) + f(1)\right]$

$= \frac{1}{4}[6.471] = \boxed{1.618}$