§ 2.3

- $$\lim_{x \to 3} \frac{x^2-x-6}{x^2-9} = \lim_{x \to 3} \frac{\cancel{(x-3)}(x+2)}{\cancel{(x-3)}(x+3)}$$

$$= \lim_{x \to 3} \frac{x+2}{x+3} = \frac{3+2}{3+3} = \frac{5}{6}$$

- $$\lim_{\theta \to 0} \frac{\sec\theta \tan\theta}{\theta} = \lim_{\theta \to 0} \frac{\frac{1}{\cos\theta} \cdot \frac{\sin\theta}{\cos\theta}}{\theta}$$

$$= \lim_{\theta \to 0} \frac{1}{\cos^2\theta} \cdot \frac{\sin\theta}{\theta}$$

$$= \left(\lim_{\theta \to 0} \frac{1}{\cos^2\theta}\right)\left(\lim_{\theta \to 0} \frac{\sin\theta}{\theta}\right)$$

$$= \frac{1}{\cos^2(0)} \cdot 1$$

$$= 1$$

§2.6

$0 \le x \le 2$

$$f(x) = \begin{cases} x^2+k & 0 \le x \le 1 \\ -2kx+4 & 1 < x \le 2 \end{cases}$$

f is a polynomial on [0, 1] and on (1, 2], so the only point to check for continuity is $x=1$:

$$f(1) = (1)^2 + k = 1+k$$

$$\lim_{x\to 1^-} f(x) = 1+k \text{ because}$$

$$\lim_{x\to 1^+} f(x) = \lim_{x\to 1^+} -2kx+4$$

$$= -2k(1)+4 = -2k+4$$

$$\lim_{x\to 1} f(x) = 1+k = -2k+4$$

$$3k = 3$$

$$\boxed{k=1}$$

$y = 3x + 2$ tan to $f(x)$ $x = 1$ §3.2

$y = -5x + 6$ $g(x)$ $x = 1$

$h(1) = f(1)g(1)$

$h(x) = f(x)g(x)$

$h'(x) = f'(x)g(x) + f(x)g'(x)$

$h'(1) = f'(1)g(1) + f(1)g'(1)$

$(3)(1) + 5(-5)$

$= 3 - 25 = -22$

$$\boxed{y - 5 = -22(x - 1)}$$

$\frac{d}{dx}(\sin x = \sin y)$ §3.7

$\frac{d}{dx}\left(\cos x = \frac{dy}{dx} \cdot \cos y\right) \rightarrow \frac{dy}{dx} = \frac{\cos(x)}{\cos y}$

$-\sin x = \left(\frac{d^2y}{dx}\right) \cdot \cos y + \frac{dy}{dx}(-\sin y)\frac{dy}{dx}$

$\frac{f(x)}{f(y)}$

§3.4

- $f(x) = (1 + \sec x)\sin^3 x$

$$f'(x) = (0 + \sec x \tan x)\sin^3 x + (1 + \sec x)(3\sin^2 x \cos x)$$

- $g(x) = \dfrac{\sin x + \cot x}{\cos x}$

$$= \frac{\sin x}{\cos x} + \frac{\cot x}{\cos x} = \frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}\left(\frac{1}{\cos x}\right)$$

$$= \tan x + \csc x$$

$$g'(x) = \sec^2 x - \csc x \cot x$$

§3.7

Find $\frac{dz}{dw}$ for

$$e^{2w} = \sin(wz)$$

$$\frac{d}{dw}\left[e^{2w} = \sin(wz)\right]$$

$$2e^{2w} = \cos(wz)\left[(w)\frac{dz}{dw} + (1)z\right]$$

$$= (\cos(wz))w\frac{dz}{dw} + (\cos(wz))z$$

$$\Rightarrow \frac{dz}{dw} = \frac{2e^{2w} - z\cos(wz)}{w\cos(wz)}$$