SI #3

Get Critical Number(s)

$f(x) = x^2 + 4x$

Get Domain

$x^2 + 4x$

$=$

$x(x+4)$

$x = 0$

$x + 4 = 0$

$-4 \quad -4$

$x = -4$

$(-1): -1(-1+4)$

$-1(-3)$

3

$(1): 1(1+4)$

$1(5)$

5

$(5): 5(5+4)$

$5(9)$

45

$(-\infty, \infty)$

Derivative of $f'(x)$

$f'(x) = \frac{d}{dx}[x^2 + 4x]$

$=$

$f'(x) = \frac{d}{dx}[x^2] + \frac{d}{dx}[4x]$

$f'(x) = 2x^1 + 4 \cdot \frac{d}{dx}[x]$

$=$

$f'(x) = 2x + 4\frac{dx}{dx}$

$=$

$f'(x) = 2x + 4 \cdot 1$

$=$

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

5I #3 cont

Domain of $f'(x) = 2x+4$

$(-\infty, \infty)$ ← No underlined

Set $f'(x) = 0$

$$2x + 4 = 0$$
$$-4 \quad -4$$
$$\frac{2x}{2} = \frac{-4}{2}$$
$$x = -2$$

f' has one critical number which is -2

Example 6

$f(x) = 1/x$

Get Domain

$f(x) = 1/x \quad x < 0 \text{ or } x > 0$

$(-\infty, 0) \cup (0, \infty)$

Get Derivative

$f'(x) = \frac{d}{dx}\left[\frac{1}{x}\right] \quad f(x)=1,\ g(x)=x$

$$f'(x) = \frac{x \cdot \frac{d}{dx}[1] - 1 \cdot \frac{d}{dx}[x]}{x^2}$$

$$f'(x) = \frac{x \cdot 0 - 1 \cdot \frac{dx}{dx}}{x^2}$$

$$f'(x) = \frac{0 - 1}{x^2}$$

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

Domain of $f'(x)$

$x < 0$ or $x > 0$

$(-\infty, 0) \cup (0, \infty)$

Domain of $f(x)$

$(-\infty, 0) \cup (0, \infty)$

Domain of $f'(x)$

$(-\infty, 0) \cup (0, \infty)$

$$f'(0) = \frac{-1}{0^2}$$

$$\boxed{f'(0) = \text{undef}}$$

undefined

Example 6 Cont

Set $f'(x) = 0$

$$\frac{x^2}{-1} \cdot \frac{-1}{x^2} = 0 \cdot \frac{x^2}{-1}$$

$$\frac{-x^2}{-x^2} = 0$$

$$1 = 0$$

False / No Solutions for $f'(x) = 0$

f has no critical values

1. $f'(0)$ is undefined but 0 is not in the domain of $f(x)$

2. There are no solutions when $f'(x) = 0$

Example 4

$f(x) = x^{1/2}$

$= \sqrt{x}$

$= \sqrt{x}/1$

Get Domain

$x \geq 0$

$[0, \infty)$

Get Derivative

$f'(x) = \frac{d}{dx}[x^{1/2}]$

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

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

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

$f'(x) = \frac{1}{2\sqrt{x}}$

Get Domain of $f'(x)$

$f'(x) = \frac{1}{2\sqrt{x}}$, $x > 0$

$(0, \infty)$

Domain of $f(x)$

$[0, \infty)$

0 is in domain of $f(x)$ here

$f(0) = 0^{1/2}$

$= \sqrt{0}$

$f(0) = 0$

Domain of $f'(x)$

$(0, \infty)$

0 is undefined for $f'(x)$

$f'(0) = \frac{1}{2\sqrt{0}}$

$= \frac{1}{2 \cdot 0}$

$= \frac{1}{0}$

$f'(0) =$ undef

$f'(c)$ is undefined, where $c = x$

f has one critical number which is 0

Example 5

① Get critical numbers of $f(x) = \sin(x)$

② Get Domain of $f(x)$

$f(x) = \sin(x)$ $\quad$ Domain

$(-\infty, \infty)$

③ Get Derivative of $f(x)$

$$f'(x) = \frac{d}{dx}[\sin(x)]$$

$$\| $$

$$f'(x) = \cos(x)$$

④ Get Domain of $f'(x)$

$f'(x) = \cos(x)$ $\quad$ $(-\infty, \infty)$

There are no x values where $f'(x) = 0$ or $f'(x)$ do not exist,

⑤ Set $f'(x) = 0$

$\cos(x) = 0$ for x values $= \pi/2 + \pi k$ where k is an integer

Critical numbers of f are $x = \pi/2 + \pi k$ for any integer k.