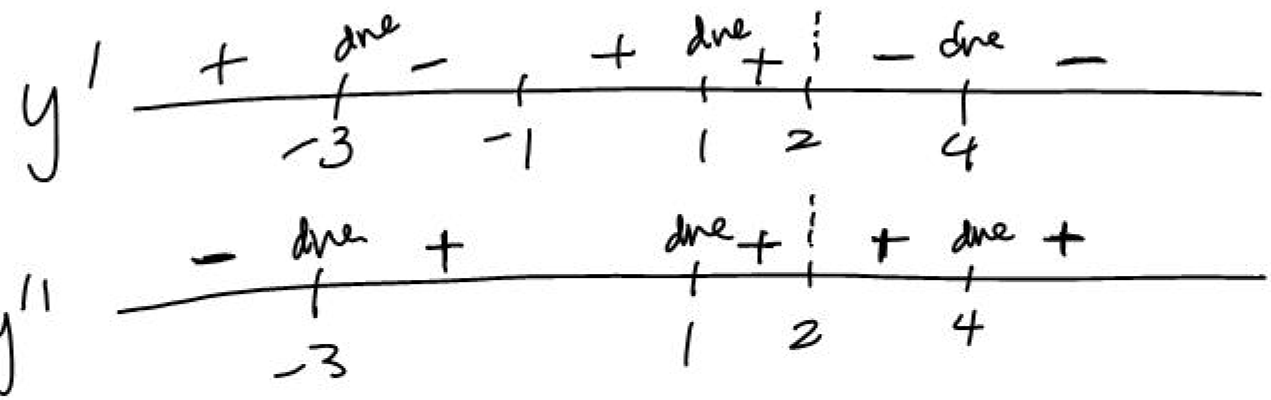
#7.



#9 ⓐ g, n ⓑ e, l ⓒ a, i

ⓓ b, j ⓔ f, m ⓕ d, h, k

ⓖ d, h, k ⓗ f(i) ⓘ f(0)

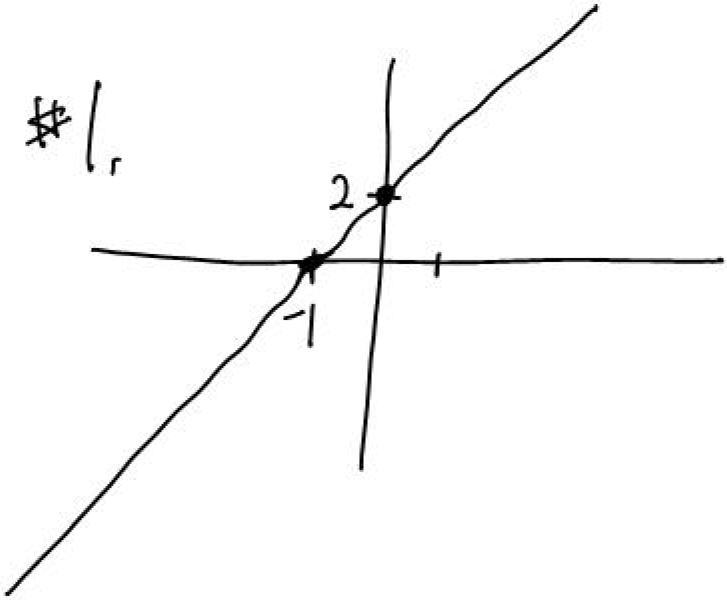
ⓙ f''(c) ⓚ f''(l)

#10 ⓐ $(-\infty, -1.5] \cup [1.2, 2.5]$

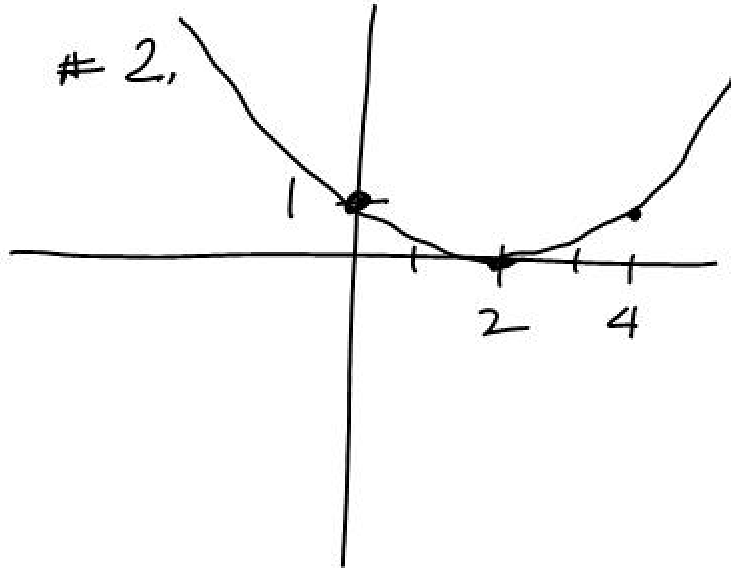
ⓑ $x = 1.2$ ⓒ $x = -1.5, 2.5$

ⓓ $[0, 2]$ ⓔ $x = 0, x = 2$

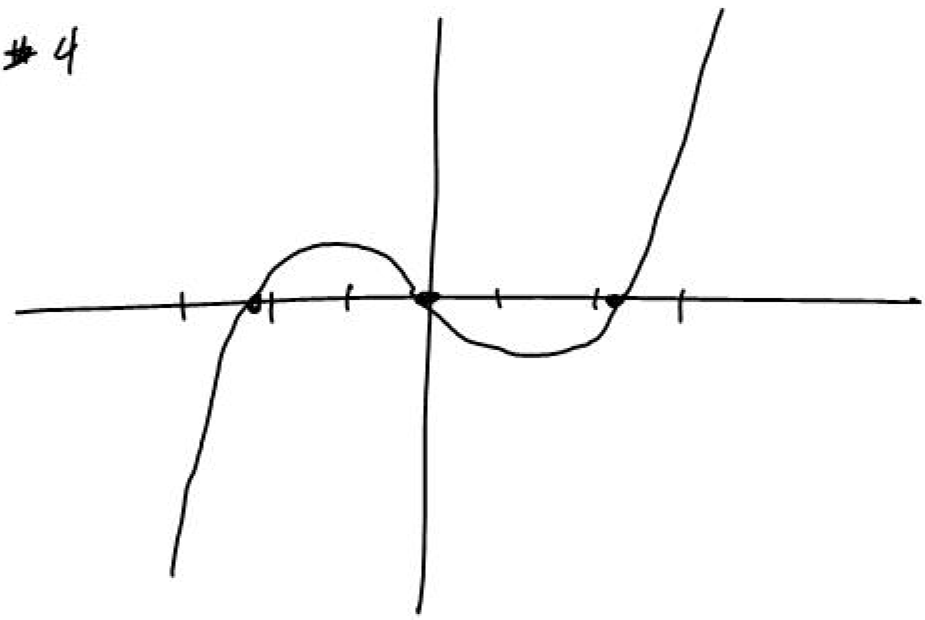
#1.



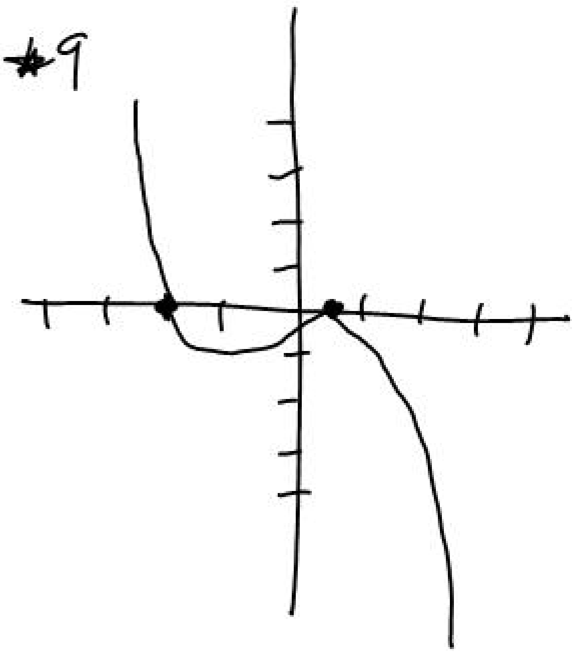
#2.



#4



#9



Review the Binomial Theorem

$$(x+h)^n = \binom{n}{n} x^n + \binom{n}{n-1} x^{n-1} h + \binom{n}{n-2} x^{n-2} h^2$$

$$+ \cdots + \binom{n}{0} h^n$$

$$= x^n + n \cdot x^{n-1} h + \binom{n}{2} x^{n-2} h^2 + \cdots + h^n$$

Given $f(x) = x^n$, find $f'(x)$.

$$f'(x) = \lim_{h \to 0} \frac{(x+h)^n - x^n}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{x^n} + n x^{n-1} h + \binom{n}{2} x^{n-2} h^2 + \cdots + h^n - \cancel{x^n}}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}\left[n x^{n-1} + \binom{n}{2} x^{n-2} \overset{0}{h} + \overset{0}{\cdots} + \overset{0}{h^{n-1}}\right]}{\cancel{h}}$$

$$= n x^{n-1}$$

The Power Rule

$$\boxed{\text{If } f(x) = x^n,\ f'(x) = n x^{n-1}}$$

Ex. $f(x) = \frac{1}{\sqrt{x}}$. find $f'(x)$

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

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

use the power rule to get $f'(x)$

Ex. $g(x) = \frac{1}{x^4}$. find $g'(x)$.

$$g(x) = \frac{1}{x^4} = x^{-4}$$

$$g'(x) = -4x^{-5} = \frac{-4}{x^5}$$

More Shortcuts

The Sum Rule: If $f(x) = u(x) + v(x)$

then $f'(x) = u'(x) + v'(x)$

The Constant Multiple Rule

If $f(x) = c \cdot u(x)$

then $f'(x) = c \cdot u'(x)$

The Constant Rule

If $f(x) = c$, then $f'(x) = 0$

Ex, $f(x) = 4x^2 - 8x + 5$ Find $f'(x)$.

$f'(x) = 4 \cdot 2x^1 - 8 \cdot 1 + 0$

$8x - 8$

Ex, $f(x) = 5x^2 + 9x - 10$

$f'(x) = 10x + 9$

Ex, $f(x) = \underbrace{4 - 3x}_{} + \underbrace{5x^2}_{} \underbrace{- 9x^3}_{}$

$f'(x) = -3 + 10x - 27x^2$

Ex: $f(x) = \dfrac{3x - 2x^2}{x}$ Find $f'(x)$

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

$$f'(x) = -2, \quad x \neq 0$$

Recalling the joys of Pre Cal (Trig identities)

$$\sin^2\theta + \cos^2\theta = 1$$

$$1 + \tan^2\theta = \sec^2\theta$$

$$\sin 2\theta = 2\sin\theta\cos\theta$$

$$\cos 2\theta = \cos^2\theta - \sin^2\theta \quad \text{vanilla}$$

$$= 2\cos^2\theta - 1 \quad \text{choc}$$

$$= 1 - 2\sin^2\theta \quad \text{strawb}$$

$$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \sin\beta\cos\alpha$$

$$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$

If $f(x) = \sin x$, find $f'(x)$.

$$f'(x) = \lim_{h \to 0} \frac{\sin(x+h) - \sin x}{h}$$

$$= \lim_{h \to 0} \frac{\sin x \cos h + \sin h \cos x - \sin x}{h}$$

$$= \lim_{h \to 0} \left[\sin x \cdot \underbrace{\frac{\cos h - 1}{h}}_{\to 0} + \cos x \cdot \underbrace{\frac{\sin h}{h}}_{\to 1} \right]$$

$$= \cos x$$

If $f(x) = \cos x$, $f'(x) = -\sin x$.

If $f(x) = e^x$, $f'(x) = e^x$

The Product Rule

If $f(x) = u(x) \cdot v(x)$

then $f'(x) = u(x) \cdot v'(x) + v(x) \cdot u'(x)$

the 1st   deriv of the 2nd   2nd   deriv of the first

Ex. $f(x) = x^2 \cdot \sin x$

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

Ex. $f(x) = e^x \cdot \cos x$

$f'(x) = -e^x \cdot \sin x + \cos x \cdot e^x$

$= e^x (\cos x - \sin x)$