Calculus AB Study Guide: sections 2.6 – 3.2

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Simplify: $$\lim_{h \to 0} \frac{\frac{1}{2+h} - \frac{1}{2}}{h}$$ $= \frac{d}{dx}\left(\frac{1}{x}\right)$ at $x=2$

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

answer: $-\frac{1}{4}$

Find the limits.

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

answer: 5

$$\lim_{x \to 3} \frac{x^2+x-6}{x-3}$$ $\frac{(x+3)(x-2)}{(x-3)} \longrightarrow \frac{6(1)}{0}$ ∞ or DNE

answer: DNE

$\lim_{x \to 0} \frac{\sin 2x}{5x} \to \frac{\frac{2}{5} \sin 2x}{2x} = \frac{2}{5} \cdot 1 = \frac{2}{5}$

answer: $\frac{2}{5}$

$\lim_{h \to 0} \frac{\cos h - \cos^2 h}{h} = \frac{\overset{1}{\uparrow}}{\cos h} \frac{(1 - \cos h)}{h} \to 0 = 1 \cdot 0 = 0$

answer: 0

Does the equation $2^x = 3$ have a solution on the x-interval (1, 2)? Yes No

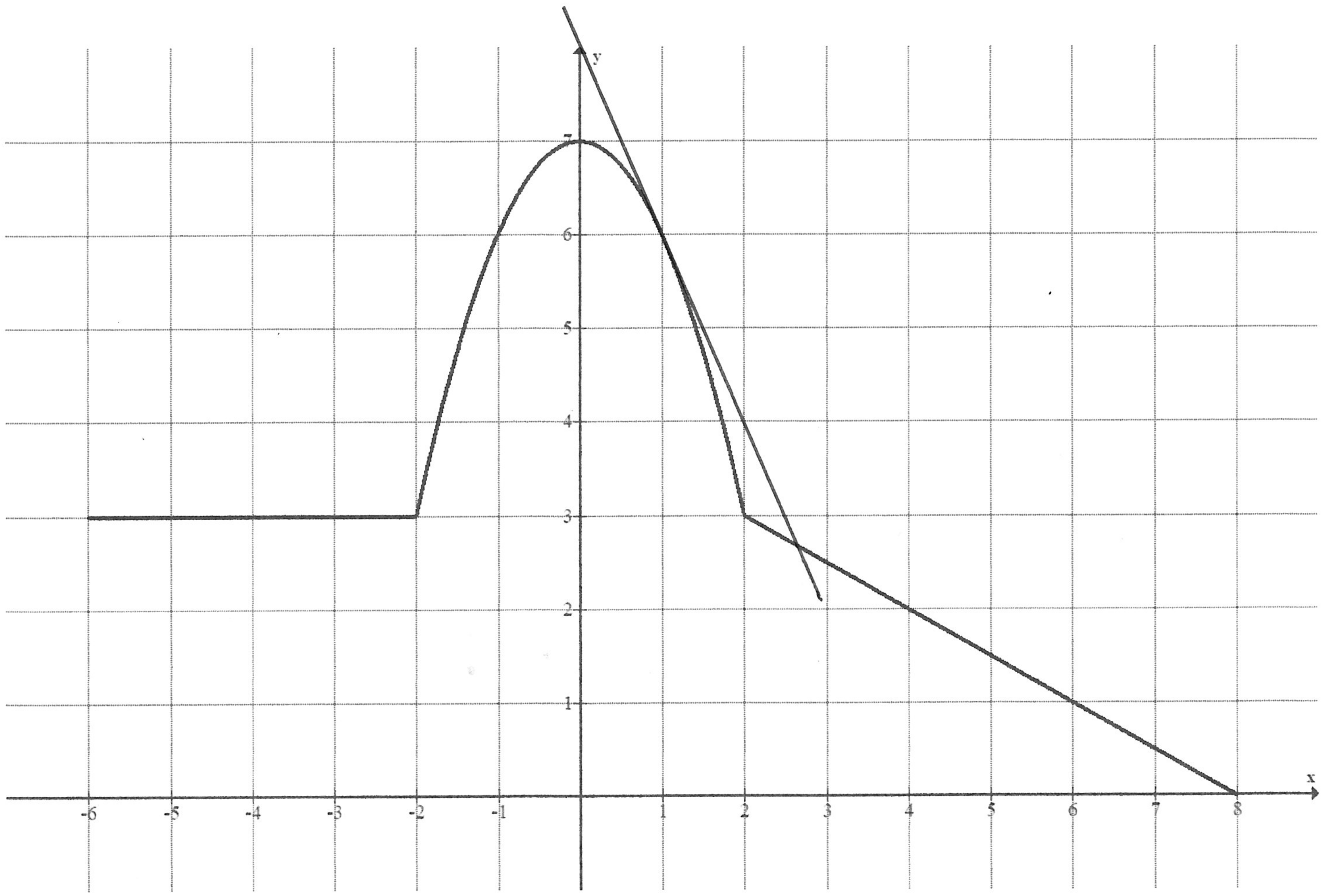
Why or why not? Intermediate Value Theorem

Use the limit definition of the derivative (not the power or quotient rule) to find f'(x) if $f(x) = \frac{1}{x+3}$.

$\lim_{h \to 0} \frac{\frac{1}{x+h+3} - \frac{1}{x+3}}{h} \quad \frac{x+3 - (x+h+3)}{(x+3)(x+h+3)h} = \frac{-h}{(x+3)(x+h+3)h}$

$= -\frac{1}{(x+3)(x+h+3)} = \frac{-1}{(x+3)^2}$

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



Given the function h(x) above, find h'(-4) and h'(4). Estimate the average rate of change of h on the x-interval (0, 2). And estimate h'(1).

h'(-4) = 0

h'(4) = $-1/2$

avg. rate of change ≈ -2 $\quad \frac{7-3}{0-2} = \frac{4}{-2} = -2$

h'(1) ≈ ______ draw tangent line (0, 8) + (2, 4) are on tangent

$\frac{4}{-2} = -2$

Given the piecewise-defined function h(x):

$h(x) = -x^2 + b$, for $x \leq 2$

$x - 1$, for $x > 2$

what value of b ensures that h(x) is continuous?

$-x^2 + b = x - 1$ $\qquad b = 5$

$-4 + b =$

answer: ______________________

For the function $g(x) = x^3$, find a linearization (e.g. a tangent line) at $x = 2$.

$g'(x) = 3x^2 \qquad g(2) = 8$

$g'(2) = 12$

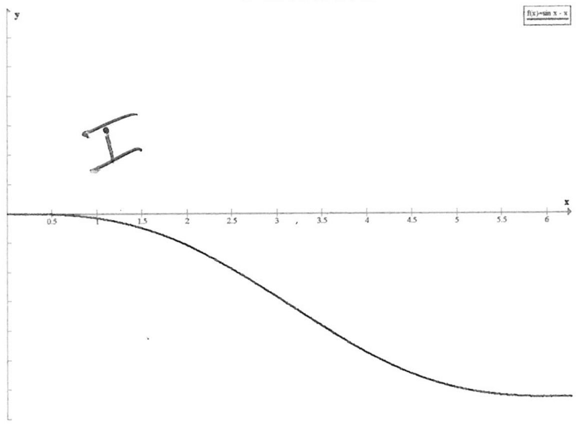
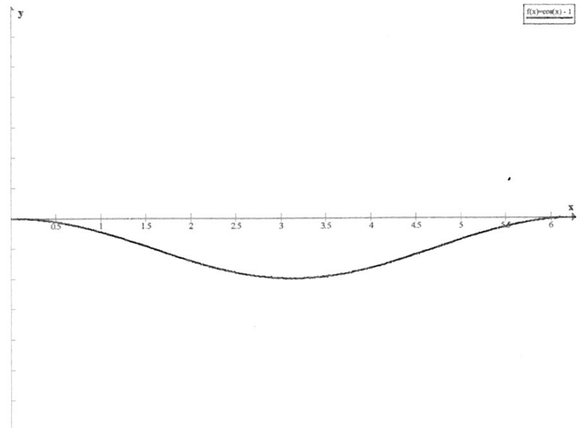
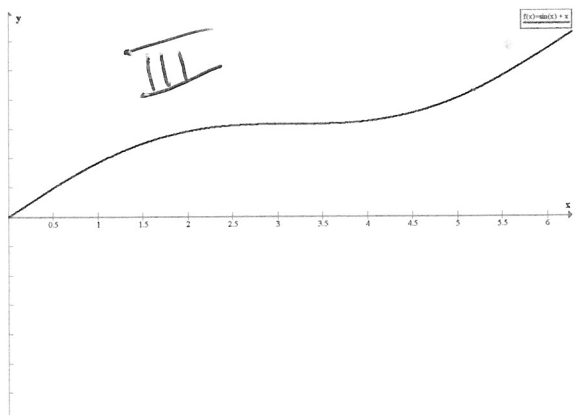
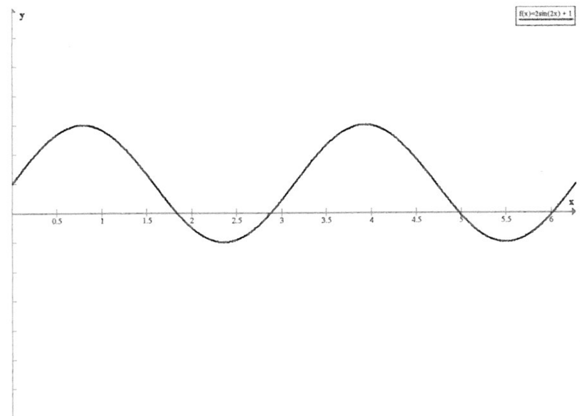
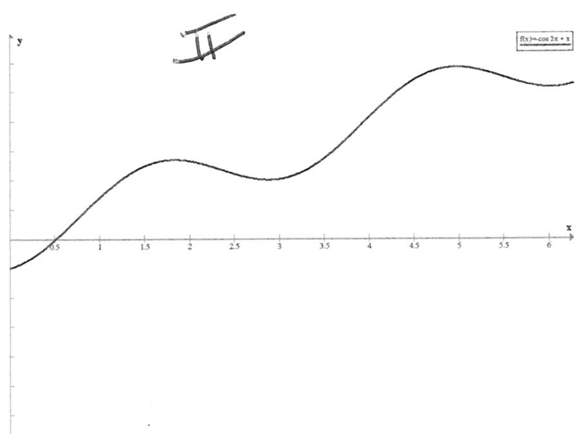
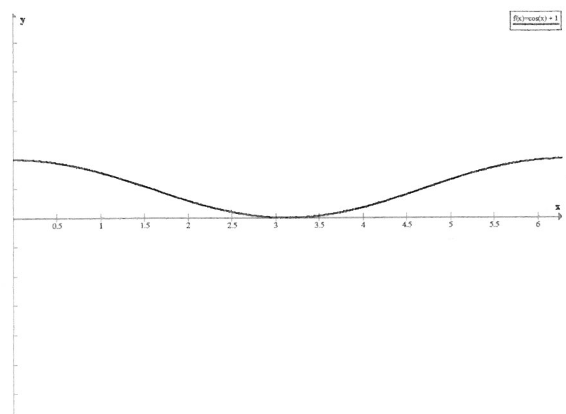
answer: $y - 8 = 12(x-2) \qquad y = 12x - 24 + 8 = 12x - 16$

Use the tangent line (not g(x)) to estimate g(2.1).

$y = 12(2.1) - 16 = 9.2$

answer: ______________________

Match each function with its derivative. Write I, II or III to the left of the function.

Functions	Derivatives
	 (I)
	 (II)
	 (III)

f(x) = $\frac{2}{3}x^{3\pi} + \sqrt{2}x^{\sqrt{3}}$

Find the slope of the tangent line to f at x = 1.

$f'(x) = \frac{2}{3} \cdot 3\pi x^{3\pi - 1} + \sqrt{6} x^{\sqrt{3}-1}$

$f'(1) = 2\pi + \sqrt{6}$

answer: $2\pi + \sqrt{6}$