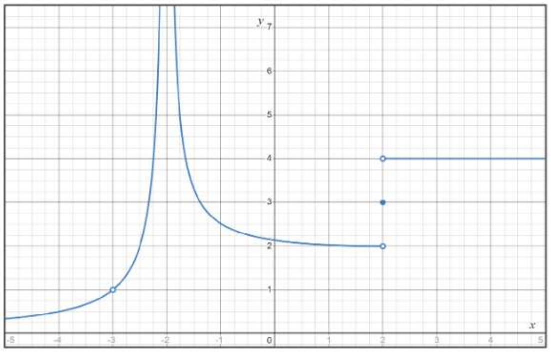
Question 2 of 54

If $f(x)$ has the graph sketched below, then $\lim\limits_{x \to 2^-} f(x) =$



- 1
- 3
- The limit does not exist.
- ∞
- 2
- 4

$\lim\limits_{x \to 2^-} f(x) = 2$

$\lim\limits_{x \to 2^+} f(x) = 4$

$\lim\limits_{x \to 2} f(x)$ DNE

$f(2) = 3$

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Find $f'(2\pi)$ if $f(x) = (x^2 + 4)(x + \sin x)$.

- $16\pi^2 + 4$
- 8π
- $16\pi^2 + 8$
- $12\pi^2 + 2\pi + 4$
- $8\pi^3 + 8\pi$
- -16π

$\rightarrow f'(x) = 2x(x + \sin(x)) + (x^2+4)(1+\cos x)$

$f'(2\pi) = 2(2\pi)[2\pi + \cancel{\sin(2\pi)}^{0}]$

$+ [(2\pi)^2 + 4](1 + \cancel{\cos(2\pi)}^{1})$

$= 2 \cdot 2\pi \cdot 2\pi + [4\pi^2 + 4] \cdot 2$

$= 8\pi^2 + 8\pi^2 + 8$

$= 16\pi^2 + 8$

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If $y = \left(\frac{7x}{3x+5}\right)^2$, then $\frac{dy}{dx} =$

- (selected) $\frac{490x}{(3x+5)^3}$
- $\frac{14x}{3x+5}$
- $\frac{98x}{9x+15}$
- $\frac{49x^2}{(3x+5)^2}$
- $-\frac{490x}{(3x+5)^3}$
- $\frac{14x}{(3x+5)^2}$

$$y = \left(\frac{7x}{3x+5}\right)^2$$

$$y' = 2\left(\frac{7x}{3x+5}\right)\frac{d}{dx}\left(\frac{7x}{3x+5}\right)$$

$$= 2\left(\frac{7x}{3x+5}\right)\left[\frac{7(3x+5) - 7x\cdot 3}{(3x+5)^2}\right]$$

$$= 2\left(\frac{7x}{3x+5}\right)\left[\frac{\cancel{21x} + 35 - \cancel{21x}}{(3x+5)^2}\right]$$

$$= \frac{490x}{(3x+5)^3}$$

Question 31 of 54

$P'(t) = 1600t - 700$

The population of a city since the year 2000 can be modeled as $P(t) = 800t^2 - 700t + 50000$ where $t = 0$ corresponds to the year 2000. In which year is the population increasing at a rate of 8900 people per year?

- 2009
- 2008
- 2004
- 2005
- (selected) 2006
- 2007

$P'(t) = 8900$

$1600t - 700 = 8900$

$16\cancel{0}\cancel{0}t = 96\cancel{0}\cancel{0}$

$t = \frac{96}{16} = 6 \rightarrow 2006$

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$=0 \Rightarrow x = 0, -2, 4$

Suppose the derivative of $f(x)$ is $f'(x) = x^3(x+2)(x-4)$. At what x-value(s) does $f(x)$ have a local maximum?

$+ \cdot + \cdot +$

- ~~$x = 4$~~
- (selected) $x = 0$
- $x = 0$ and $x = 4$
- ~~$x = -2$~~
- ~~$x = -2$~~ and $x = 4$
- ~~$x = -2$~~ and $x = 0$

∪ ∩ ∪

$-$ $+$ $-$ $+$

-3 -1 1 5

-2 0 4 f'

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Question 25 of 54

Use implicit differentiation to find the [illegible] the tangent line to the graph of

$$x^3 + y^3 = 6xy$$

at the point (3,3).

- 3
- 0
- 1
- −5
- 6
- −1

$$\frac{d}{dx}(x^3+y^3) = \frac{d}{dx}(6xy)$$

$$3x^2\frac{dx}{dx} + 3y^2\frac{dy}{dx} = \frac{d}{dx}(6x)\cdot y + 6x\frac{d}{dx}(y)$$

$$3x^2 + 3y^2\frac{dy}{dx} = 6\cdot y + 6x\frac{dy}{dx}$$

Plug (3,3) into eqn

$$3\cdot 3^2 + 3\cdot 3^2\frac{dy}{dx} = 6\cdot 3 + 6\cdot 3\frac{dy}{dx}$$

$$27 + 27\frac{dy}{dx} = 18 + 18\frac{dy}{dx}$$

$$-27 \quad -18\,dy/dx \quad -27 \quad -18\,dy/dx$$

$$9\frac{dy}{dx} = -9$$

$$\frac{dy}{dx} = -1$$

Tangent Line:

$$y - y_1 = m(x - x_1)$$

$$y - 3 = -1(x-3)$$

$$y - 3 = -x + 3$$

$$+3 \qquad +3$$

$$y = -x + 6$$

Puzzle: Given that $\int_{-2}^{4} f(x)dx = 2$; $\int_{2}^{5} f(x)dx = 3$ and $\int_{4}^{2} f(x)dx = -2$

$$\int_{2}^{4} f(x)dx = 2$$

compute $\int_{-2}^{5} f(x)dx = 3$