AP Calculus AB
Lessons 3-1 & 4-3 Learning Check

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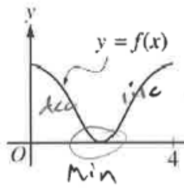
1. If $f''(x) = x(x+2)^2$, then the graph of f is concave up for

(A) $x < 0$
(B) $x > 0$
(C) $-2 < x < 0$
(D) $x < -2$ and $x > 0$
(E) all real numbers

x $-$ | $-$ | $+$
$(x+2)^2$ $+$ | $+$ | $+$
$-$ -2 $-$ 0 $+$
CC ↑

$0 = x(x+2)^2$
$x=0 \quad x=-2$

2.

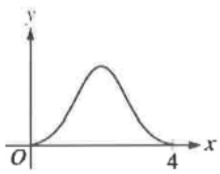


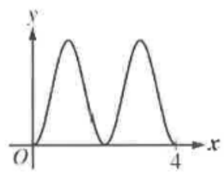
Looks like cosine graph

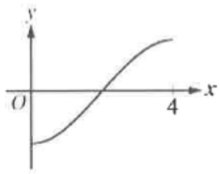
Min

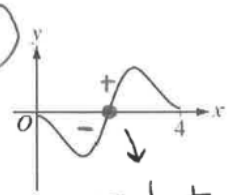
$\frac{d}{dx}(\cos x) = -\sin x$

The graph of $y = f(x)$ on the closed interval $[0, 4]$ is shown above. Which of the following could be the graph of $y = f'(x)$?

(A)


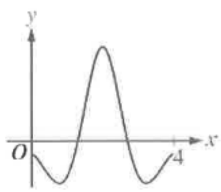
(B)


(C)


(D)


$-$ | $+$

Min

(E)


3. Let f be the function with derivative defined by $f'(x) = x^3 - 4x$. At which of the following values of x does the graph of f have a point of inflection? f'' ↖ 1st deriv.

(A) 0 (B) $\frac{2}{3}$ (C) $\frac{2}{\sqrt{3}}$ (D) $\frac{4}{3}$ (E) 2

$$f''(x) = 3x^2 - 4$$
$$0 = 3x^2 - 4$$
$$\frac{4}{3} = \frac{3x^2}{3} \quad \sqrt{x^2} = \sqrt{\frac{4}{3}} \quad x = \pm\frac{2}{\sqrt{3}}$$

4. Let f be the function given by $f(x) = \dfrac{kx}{x^2+1}$, where k is a constant. For what values of k, if any, is f strictly decreasing on the interval $(-1, 1)$? strictly decreasing means $f'(x) < 0$

(A) $k < 0$

(B) $k = 0$

(C) $k > 0$

(D) $k > 1$ only

(E) There are no such values of k.

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

on $(-1,1)$ always positive

$\frac{k \cdot +}{+}$ must be neg.

Always pos.

5. Let $y = f(x)$ define a twice-differentiable function and let $y = t(x)$ be the line tangent to the graph of f at $x = 2$. If $t(x) \geq f(x)$ for all real x, which of the following must be true?

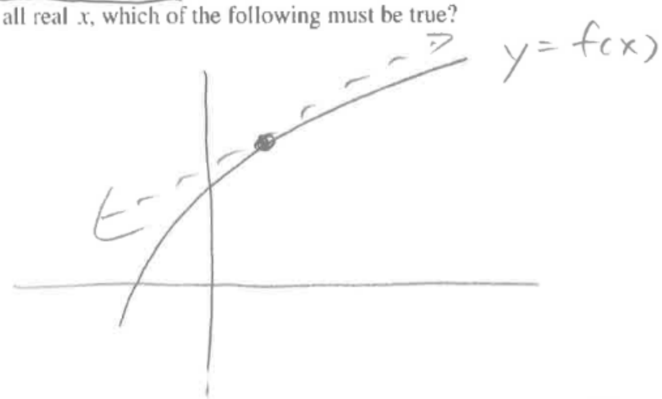
(A) $f(2) \geq 0$

(B) $f'(2) \geq 0$

(C) $f'(2) \leq 0$

(D) $f''(2) \geq 0$

(E) $f''(2) \leq 0$



If $t(x) \geq f(x)$, then the T.L. is always above $f(x)$.
This means the graph is CC↓.
So $f'' < 0$.