Name: _____ Date: _____

AP Calculus AB Ms. Loughran

Do Now:

1. Given $y = \dfrac{1 + x\tan x}{\sin x \sec x}$, find y'.

$\sin x \cdot \frac{1}{\cos x}$

$y = \dfrac{1 + x\tan x}{\tan x}$

$y = \dfrac{1}{\tan x} + \dfrac{x\tan x}{\tan x}$

$y = \cot x + x$

$y' = -\csc^2 x + 1$ or $1 - \csc^2 x$

$y' = -\cot^2 x$

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

$1 + \cot^2 x = \csc^2 x$

RADIAN MODE
Zoom 6 Window

* 3 decimal places (rounded or truncated)

Name: _____ Date: _____

AP Calc AB: Calculator Active Questions Ms. Loughran

1. The function f defined by $f(x) = e^{3x} + 6x^2 + 1$ has a horizontal tangent at $x =$

(A) –0.144 (B) –0.150 (C) –0.156 (D) –0.162 (E) –0.168

Plan:
$f'(x) = 0$
$y_1 = f(x)$
$y_2 \rightarrow$ math 8 $\frac{d}{dx}(Y_1)\big|_{x=x}$ (alpha trace)

calculate it as a zero
or
Plug $y_3 = 0$ and do it as a pt of intersection

or (2nd window Independent: Ask) and plug in choices for x

2. Let $f(x) = 2e^{3x}$ and $g(x) = 5x^3$. At what value of x do the graphs of f and g have parallel tangents?

$f'(x) = 2 \cdot e^{3x} \cdot 3 = 6e^{3x}$ $g'(x) = 15x^2$

(A) –0.445 (B) –0.366 (C) –0.344 (D) –0.251 (E) –0.165

Plan: find where they have same slope
$f'(x) = g'(x)$

$Y_1 = f'(x)$
$Y_2 = g'(x)$
} pt of intersection

3. Let f be the function given by $f(x) = 5e^{3x^3}$. For what positive value of a is the slope of the line tangent to the graph of f at $(a, f(a))$ equal to 6?

(A) 0.142 (B) 0.344 (C) 0.393 (D) 0.595 (E) 0.714

Plan: $f'(x) = 6$

$y_1 = f(x)$
$y_2 = f'(x)$
$y_3 = 6$
} pt of intersection

4. An object moves along the x-axis so that at time t, $t \geq 0$, its position is given by $x(t) = t^4 + t^3 - 30t^2 + 88t$. At the instant when the acceleration becomes zero, the velocity of the object is approximately

(A) 244 (B) 12 (C) 0 (D) –12 (E) –24

$y_1 = x(t)$
$y_2 = x'(t)$ $\left(\frac{d}{dx}(Y_1)\big|_{x=x}\right)$
$y_3 = x''(t)$ $\left(\frac{d}{dx}(Y_2)\big|_{x=x}\right)$
$y_4 = 0$
} pt of intersection

store x → A and then do $Y_2(A)$

Homework 10-19

Name: Key

AP Calculus AB Intro to Linear Motion - Multiple Choice Practice

1) A particle moves along the x-axis so that its position at time t is given by $x(t) = 2t^2 - 12t + 9$. For what value of t is the particle at rest?

A) 1 B) 9 C) 3 D) 4 E) 0

$v(t) = 4t - 12$

$4t - 12 = 0$

$t = 3$

2) A particle travels along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = t^3 - 9t^2 + 24t + 2$. For what value(s) of t is the velocity equal to zero?

A) $t = 3$, only B) $t = 0$ and $t = 3$ C) $t = 4$, only
D) $t = 2$, only E) $t = 2$ and $t = 4$

$v(t) = 3t^2 - 18t + 24$

$v(t) = 3(t^2 - 6t + 8)$

$3(t-4)(t-2) = 0$

$t = 4 \mid t = 2$

3) A particle moves along a horizontal axis so that its position is given by $x(t) = 4t^5 - 5t^3$ for any time t. How many times does the particle change direction?

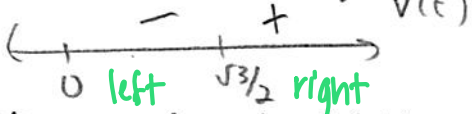
A) 1 B) 2 C) 3 D) 0 E) 5

$v(t) = 0$

$t^2 = \frac{3}{4}$

$t = \pm\frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2} = .866$



$v(t) = 20t^4 - 15t^2$

$v(t) = 5t^2(4t^2 - 3)$

$0 = 5t^2(4t^2 - 3)$

4) A particle moves on the x-axis such that its position at any time $t > 0$ is given by $x(t) = t^3 - 9t^2 + 24t$. What is the velocity of the particle when its acceleration is zero?

A) 24 B) 105 C) 3 D) 0 E) -3

$v(t) = 3t^2 - 18t + 24$

$a(t) = 6t - 18$

$t = 3$

$v(3) = 27 - 54 + 24 = -3$

5) A particle moves along a horizontal axis so that its position is defined by $S(t) = 4\cos\frac{\pi}{2}t$ for $0 \leq t \leq 5$. What is the velocity of the particle at the time its acceleration is first equal to zero?

A) -4π B) 4π C) -2π D) $-\pi^2$ E) 2π

$v(t) = -4\sin\left(\frac{\pi}{2}t\right) \cdot \frac{\pi}{2} = -\pi\sin\left(\frac{\pi}{2}t\right)$

$a(t) = -\pi\cos\left(\frac{\pi}{2}t\right) \cdot \frac{\pi}{2} = -\frac{\pi^2}{2}\cos\left(\frac{\pi}{2}t\right)$

6) A particle moves along the x-axis in such a way that its position at any time t is given by $x(t) = t^4 - 8t^3 + 18t^2 + 2$ for $t > 0$. At what time is acceleration of the particle equal to 36?

A) 3 B) 4 C) 12 D) 2 E) 6

$v(t) = 4t^3 - 24t^2 + 36t$

$a(t) = 12t^2 - 48t + 36$

$12t^2 - 48t + 36 = 36$

$12t^2 - 48t = 0$

$12t(t - 4) = 0$

$t = 0$

$t = 4$

7) A particle moves along the x-axis so that at any time $t \geq 0$, its position is given by $x(t) = 2t + \sin(\pi t)$. What is the acceleration of the particle at time $t = \frac{3}{2}$?

A) 0 B) π C) 2 D) π^2 E) $-\pi^2$

54-18

$v(t) = 6t^2 - 6t$

8) If the position of a particle moving on the x-axis at any time t is given by $x(t) = 2t^3 - 3t^2$, what is the average acceleration of the particle for $0 \leq t \leq 3$?

A) 15 B) 9 C) 8 D) 12 E) 18

change in v

36 0

$\frac{v(3) - v(0)}{3} = 12$

9) The position of a particle moving on a horizontal axis for time t, where $t \geq 0$, is $S(t) = 3 \sin \frac{1}{2}t + 1$. What is the average velocity of the particle for $0 \leq t \leq \frac{3\pi}{2}$?

A) $\frac{\pi}{\sqrt{2}}$ B) $\frac{\sqrt{2}}{\pi}$ C) $-\frac{\pi}{\sqrt{2}}$ D) $\frac{3\sqrt{2}}{\pi}$ E) $\frac{-\sqrt{2}}{\pi}$

$\frac{s(\frac{3\pi}{2}) - s(0)}{\frac{3\pi}{2} - 0} = \frac{\frac{3\sqrt{2}}{2} + 1 - 1}{\frac{3\pi}{2}}$

$\frac{3\sqrt{2}}{2} \cdot \frac{2}{3\pi} = \frac{\sqrt{2}}{\pi}$

(7) $v(t) = 2 + \cos(\pi t) \cdot \pi$

$a(t) = -\pi \sin(\pi t) \cdot \pi = -\pi^2 \sin(\pi t)$

$a(3/2) = -\pi^2 \sin\left(\frac{3\pi}{2}\right) = \pi^2$

$s(0) = 3 \sin 0 + 1$

$s(\frac{3\pi}{2}) = 3 \sin(\frac{3\pi}{4}t) + 1$

$3\left(\frac{\sqrt{2}}{2}\right) + 1$

$\frac{3\sqrt{2}}{2} + 1$