Do Now :

(1)

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	5	-1	1	2
2	4	-1	3	$\frac{3}{2}$
3	3	-1	4	1
4	2	-1	5	1
5	1	0	6	$-\frac{1}{2}$
6	2	1	4	-2

Part 1) Given $h(x) = f(x) + g(x)$, find $h'(2)$

Part 2) Given $k(x) = f(x) - g(x)$, find $k'(3)$

Part 3) Given $s(x) = f(x) \cdot g(x)$, find $s'(4)$

Part 4) Given $r(x) = \frac{f(x)}{g(x)}$, find $r'(2)$

Part 5) Given $q(x) = (f(x))^2$, find $q'(2)$

Part 6) Given $p(x) = f(g(x))$, find $p'(6)$

Part 1) Given $h(x) = f(x) + g(x)$, find $h'(2)$

$h'(x) = f'(x) + g'(x)$

$h'(2) = f'(2) + g'(2)$

$-1 + \frac{3}{2} = \frac{1}{2}$

Part 2) Given $k(x) = f(x) - g(x)$, find $k'(3)$

$k(x) = f'(x) - g'(x)$

$k(2) = f'(3) - g'(3)$

$-1 - 1 = -2$

Part 3) Given $s(x) = f(x) \cdot g(x)$, find $s'(4)$

$s'(x) = f(x) \cdot g'(x) + f'(x)\, g(x)$

$s(4) = (2)(1) + (-1)(5)$

-3

Part 4) Given $r(x) = \frac{f(x)}{g(x)}$, find $r'(2)$

$r'(x) = \frac{g(x) f'(x) - f(x)\, g'(x)}{g^2(x)}$

$r'(2) = \frac{3(-1) - 4(\frac{3}{2})}{3^2} = \frac{-3-6}{9} = -1$

Part 5) Given $q(x) = (f(x))^2$, find $q'(2)$

$q'(x) = 2f(x) \cdot f'(x)$

$q'(2) = 2(4) \cdot (-1) = -8$

Part 6) Given $p(x) = f(g(x))$, find $p'(6)$

$p'(x) = f'(g(x)) \cdot g'(x)$

$p'(6) = f'(4) \cdot (-2)$

$(-1)(-2) = 2$

5b) $m(x) = f(x^2)$, find $m'(2)$

$m'(x) = f'(x^2) \cdot 2x$

$m'(2) = (-1) \cdot 2(2) = -4$

$$[\ln u]' = \frac{1}{u}\cdot u'$$

$$[e^u]' = e^u \cdot u'$$

② If $y = \ln(1 \underbrace{-xe^{-x}}_{u})$, find y'.

$$y' = \frac{1}{1-xe^{-x}} \cdot \left(+xe^{-x} - 1e^{-x}\right)$$

$$y' = \frac{xe^{-x} - e^{-x}}{1-xe^{-x}} = \frac{\frac{x}{e^x} - \frac{1}{e^x}}{1-\frac{x}{e^x}} = \frac{x-1}{e^x - x}$$

③ $\frac{d}{dx} e^{5\ln x^2}$

$\frac{d}{dx} e^{\ln (x^2)^5}$

$\frac{d}{dx} e^{\ln x^{10}} = \frac{d}{dx} x^{10} = 10x^9$

* $\ln e = 1$

$\ln 1 = 0$ *

Formal definition of derivative

$$f(x+h) \quad - \quad f(x)$$

④ Find $\lim\limits_{h \to 0} \dfrac{\sec(3(x+h)) - \sec(3x)}{h} = f'(x)$

$$f(x) = \sec 3x$$

$$f'(x) = 3 \tan 3x \sec 3x$$

⑤ A particle moves along the x-axis so that at time $t \geq 0$ its position is given by $s(t) = t^3 - 6t^2 + 9t + 11$ where s is measured in feet and t is measured in seconds.

a) Find the average velocity on the interval $[0, 4]$

$$\frac{s(4) - s(0)}{4 - 0} = \frac{15 - 11}{4} = \frac{4}{4} = 1 \text{ ft/s}$$

b) During what time intervals is the particle moving to the right.

$$v(t) = 3t^2 - 12t + 9$$

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

$$0 = 3(t-1)(t-3)$$

at rest $t = 1, 3$ s

$v(t)$

+	−	+
0 right 1	left 3	right

$[0, 1) \cup (3, \infty)$

c) Find the acceleration of the particle when $t = 1$

$$a(t) = 6t - 12$$

$$a(1) = 6(1) - 12 = -6 \text{ ft/s}^2$$

⑥ Differentiate :

$$y = 3\tan^5(3x^2+4x+1)$$

$$y' = 15\tan^4(3x^2+4x+1)\sec^2(3x^2+4x+1)\cdot(6x+4)$$

⑦ Write an eq. of the tangent line to the graph of $y = \ln\left(\overset{u}{\frac{x}{2}}\right)$ at $x = 4$.

$$y' = \frac{2}{x}\cdot\frac{1}{2} = \frac{1}{x}$$

$$y'(4) = \frac{1}{4}$$

$$y(4) = \ln\left(\frac{4}{2}\right) = \ln 2$$

$$y - \ln 2 = \frac{1}{4}(x-4)$$

⑧ If $f(x) = x\ln(x^2)$, find $f'(x)$.

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

$$f'(x) = 2 + \ln x^2$$

⑨ ~~If~~ $f(x) = e^x$, find $\ln(f'(2))$

$f'(x) = e^x$

$f'(2) = e^2$

$\ln e^2 = 2$

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?

once

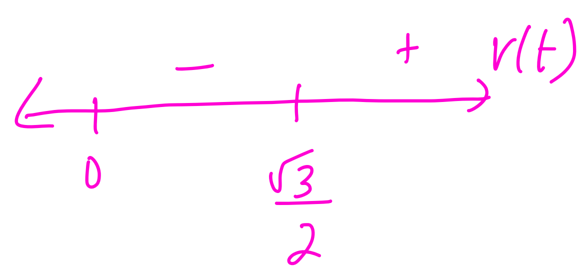
$v(t) = 0$

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

$20t^4 - 15t^2 = 0$

$\overset{+}{5t^2}(\overset{+}{4t^2} - 3) = 0$

$t = 0$	$t^2 = \frac{3}{4}$
	$t = \pm\frac{\sqrt{3}}{2}$



Answer Key to Entire AP Calculus AB multiple Choice Practice packet

Set A

① $y = \frac{x+3}{x^2+1}$ at $x=1$

at $x=1$, $y = \frac{1+3}{1^2+1} = \frac{4}{2} = 2$

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

$y'\Big|_{x=1} = \frac{2-(4)(2)}{4} = \frac{2-8}{4} = \frac{-6}{4} = \frac{-3}{2}$

$y - 2 = -3/2\,(x-1)$

$y - 2 = -3/2\,x + 3/2$

$y = -3/2\,x + 7/2$ (E)

② $f(x) = \frac{x^2-2}{x+1}$

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

$f'(3) = \frac{4(6)-7}{16} = \frac{17}{16}$ (E)

③ $\lim_{x \to 1} \frac{\ln x}{3x}$

$\frac{\ln 1}{3(1)} = \frac{0}{3} = 0$ (A)

④ $f(x) = x\sqrt{4x-1} = x(4x-1)^{\frac{1}{2}}$

$f'(x) = 1(4x-1)^{\frac{1}{2}} + \frac{1}{2}(4x-1)^{-\frac{1}{2}}(4)x$

$f'(x) = \frac{\sqrt{4x-1}}{1} + \frac{2x}{\sqrt{4x-1}}$

$\frac{4x-1+2x}{\sqrt{4x-1}} = \frac{6x-1}{\sqrt{4x-1}}$

(A)

(5) $y = -\sqrt{x+4} = -(x+4)^{\frac{1}{2}}$

$y' = -\frac{1}{2}(x+4)^{-\frac{1}{2}}(1) = -\frac{1}{2\sqrt{x+4}}\Big|_{x=0}$ $\quad -\frac{1}{4} = m_{tan}$

$m_{normal} = 4$ (E)

(6) $4x - 8y = 5$

$4x - 5 = 8y$

$\frac{1}{2}x - 5/8 = y$

$m = \frac{1}{2}$

$y = \frac{1}{2}x^2 - 3/2$

$y' = x$

$x = \frac{1}{2}$

(B)

$y = \frac{1}{2}\left(\frac{1}{2}\right)^2 - 3/2$

$y = \frac{1}{8} - 3/2 = \frac{1}{8} - \frac{12}{8} = -\frac{11}{8}$

(7) $f(x) = -x^5 + x + \frac{1}{x^2}$, $f'(-1)$

$f(x) = -x^5 + x + x^{-2}$

$f'(x) = -5x^4 + 1 - 2x^{-3}$

$f'(1) = -5(-1)^4 + 1 - 2(-1)^{-3}$

$= -5 + 1 + 2$

$= -2$ (C)

(8) $\lim\limits_{h \to 0} \frac{\overset{f(x+h)}{8\left(\frac{1}{2}+h\right)^8} - \overset{f(x)}{8\left(\frac{1}{2}\right)^8}}{h}$

$f(x) = 8x^8$ $\quad x = \frac{1}{2}$

$f'(x) = 64x^7$

$f'\left(\frac{1}{2}\right) = 64\left(\frac{1}{2}\right)^7$

$\frac{64}{128} = \frac{1}{2}$ (B)

Set B

Name: KEY Date:

AP Calc Ms. Loughran

1. An equation of the line tangent to the graph of $y = \frac{2x+3}{3x-2}$ at the point $(1,5)$ is

(A) $13x - y = 8$ (B) $13x + y = 18$ (C) $x - 13y = 64$

(D) $x + 13y = 66$ (E) $-2x + 3y = 13$

$y - 5 = -13(x-1)$

$y - 5 = -13x + 13$

$y = -13x + 18$

$y' = \frac{(3x-2)(2) - (2x+3)(3)}{(3x-2)^2}$ $x=1$ -13

2. $\lim_{h \to 0} \frac{\sin(x+h) - \sin x}{h}$ is

(A) 0 (B) 1 (C) $\sin x$ (D) $\cos x$ (E) nonexistent

$f(x) = \sin x$

$f'(x) = \cos x$

3. The value of the derivative of $y = \frac{\sqrt[3]{x^2+8}}{\sqrt[4]{2x+1}}$ at $x = 0$ is

$(x^2+8)^{\frac{1}{3}}$

(A) -1 (B) $-\frac{1}{2}$ (C) 0 (D) $\frac{1}{2}$ (E) 1

$y' = \frac{\left(\sqrt[4]{2x+1}\right) \cdot \frac{1}{3}(x^2+8)^{-2/3} \cdot 2x - \left(\sqrt[3]{x^2+8}\right)\left(\frac{1}{4}(2x+1)^{-3/4}(2)\right)}{\left((2x+1)^{\frac{1}{4}}\right)^2}$

4. An equation of the line tangent to the graph of $y = \cos(2x)$ at $x = \frac{\pi}{4}$ is

$y(\pi/4) = 0$

(A) $y - 1 = -\left(x - \frac{\pi}{4}\right)$

(B) $y - 1 = -2\left(x - \frac{\pi}{4}\right)$

(C) $y = 2\left(x - \frac{\pi}{4}\right)$

(D) $y = -\left(x - \frac{\pi}{4}\right)$

(E) $y = -2\left(x - \frac{\pi}{4}\right)$

$y' = -\sin(2x) \cdot 2$

$y'\big|_{\pi/4} = -\sin\left(\frac{2\pi}{4}\right) \cdot 2 = -1 \cdot 2 = -2$

$y - 0 = -2(x - \pi/4)$

$y = -2(x - \pi/4)$

5. The line normal to the curve $y = \sqrt{16 - x}$ at the point $(0,4)$ has slope

$(16-x)^{\frac{1}{2}}$

(A) 8 (B) 4 (C) $\frac{1}{8}$ (D) $-\frac{1}{8}$ (E) -8

$y' = \frac{1}{2}(16-x)^{-\frac{1}{2}}(-1)$

$y'\big| = \frac{1}{2}(16)^{-\frac{1}{2}}(-1)$

$\frac{1}{2}\left(\frac{1}{4}\right) = \frac{1}{8}(-1)$

$-\frac{1}{8}$

$m = +8$

6. The $\lim_{h \to 0} \frac{\tan 3(x+h) - \tan 3x}{h}$ is

(A) 0 (B) $3\sec^2(3x)$ (C) $\sec^2(3x)$ (D) $3\cot(3x)$ (E) nonexistent

$f(x) = \tan 3x$

$f'(x) = \sec^2(3x) \cdot 3$

$y = (16-x)^{\frac{1}{2}}$

$y' = \frac{1}{2}(16-x)^{-\frac{1}{2}}$

$\frac{1}{2}(16)^{-\frac{1}{2}}$

$\frac{1}{2}\left(\frac{1}{4}\right) = \frac{1}{8}$

Set C

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Derivatives

1. If $f(x) = x + \sin x$, then $f'(x) =$

a) $1+\cos x$ b) $1-\cos x$ c) $\cos x$ d) $\sin x - x\cos x$ e) $\sin x + x\cos x$

$f'(x) = 1 + \cos x$

2. If $y = \cos^2 3x$, then $\frac{dy}{dx} =$

a) $-6\sin 3x \cos 3x$ b) $-2\cos 3x$ c) $2\cos 3x$ d) $6\cos 3x$ e) $2\sin 3x\cos 3x$

$2\cos(3x) \cdot -\sin 3x \cdot 3$ $-6\cos(3x)\sin(3x)$

3. An equation of the line tangent to the graph of $f(x) = x(1-2x)^3$ at the point $(1,-1)$ is

a) $y=-7x+6$ b) $y=-6x+5$ c) $y=-2x+1$ d) $y=2x-3$ e) $y=7x-8$

$f'(x) = 1(1-2x)^3 + 3(1-2x)^2 \cdot (-2) \cdot x$

$f'(x) = (1-2x)^3 - 6x(1-2x)^2$

$f'(1) = -1 - 6(1)(1)$

$f'(1) = -1-6 = -7$

$y+1 = -7(x-1)$

$y = -7x+6$

4. $\frac{d}{dx}\left(\frac{1}{x^3} - \frac{1}{x} + x^2\right)$ at $x=-1$ is

a) -6 b) -4 c) 0 d) 2 e) 6

5. If $f(x) = \sin x$, then $f'\left(\frac{\pi}{3}\right) =$

a) $-\frac{1}{2}$ b) $\frac{1}{2}$ c) $\frac{\sqrt{2}}{2}$ d) $\frac{\sqrt{3}}{2}$ e) $\sqrt{3}$

6. If $f(x) = \sqrt{2x}$, then $f'(2) =$

a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{\sqrt{2}}{2}$ d) 1 e) $\sqrt{2}$

$f(x) = \tan 3x$

7. The $\lim_{h\to 0} \frac{\tan 3(x+h) - \tan 3x}{h}$ is

$f'(x) = \sec^2 3x \cdot 3$

a) 0 b) $3\sec^2(3x)$ c) $\sec^2(3x)$ d) $3\cot(3x)$ e) nonexistent

$(1,0)$

$f'(x) = 2(x-1)\sin x + \cos x\,(x-1)^2$

8. If $f(x) = (x-1)^2 \sin x$, then $f'(0) =$

a) -2 b) -1 c) 0 d) 1 e) 2

$f'(x) = 0 + 1$

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

9. If $f(x) = (x^2 - 2x - 1)^{\frac{2}{3}}$, then $f'(0)$ is

a) $\frac{4}{3}$ b) 0 c) $-\frac{2}{3}$ d) $-\frac{4}{3}$ e) -2

$f'(0) = \frac{2}{3}(0^2 - 2(0) - 1)^{-\frac{1}{3}} \cdot (2(0) - 2)$

$\frac{2}{3} \cdot -1 \cdot -2$

10. $\frac{d}{dx}\cos^2(x^3) =$

$2\cos(x^3) \cdot -\sin(x^3) \cdot 3x^2$

a) $6x^2 \sin(x^3)\cos(x^3)$
b) $6x^2\cos(x^3)$
c) $\sin^2(x^3)$
d) $-6x^2 \sin(x^3)\cos(x^3)$
e) $-2\sin(x^3)\cos(x^3)$

$-6x^2$

11. At what point on the graph of $y = \frac{1}{2}x^2$ is the tangent line parallel to the line $2x - 4y = 3$?

a) $\left(\frac{1}{2}, -\frac{1}{2}\right)$ b) $\left(\frac{1}{2}, \frac{1}{8}\right)$ c) $\left(1, -\frac{1}{4}\right)$ d) $\left(1, \frac{1}{2}\right)$ e) $(2,2)$

12. The position of a particle moving along a straight line at any time t is given by $s(t) = t^2 + 4t + 4$. What is the acceleration of the particle when $t = 4$?

a) 0 b) 2 c) 4 d) 8 e) 12

$s'(t) = 2t + 4$

$s''(t) = 2$

13. If $y = 2\cos\left(\frac{x}{2}\right)$, then $\frac{d^2y}{dx^2} =$

a) $-8\cos\left(\frac{x}{2}\right)$ b) $-2\cos\left(\frac{x}{2}\right)$ c) $-\sin\left(\frac{x}{2}\right)$ d) $-\cos\left(\frac{x}{2}\right)$ e) $-\frac{1}{2}\cos\left(\frac{x}{2}\right)$

$y' = -2\sin\left(\frac{x}{2}\right) \cdot \frac{1}{2} = -\sin\left(\frac{x}{2}\right)$

$y'' = -\cos\left(\frac{x}{2}\right) \cdot \frac{1}{2} = -\frac{1}{2}\cos\left(\frac{x}{2}\right)$

Set D

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1. A particle moves along a line so that at time t, where $0 \le t \le \pi$, its position is given by $s(t) = -4\cos t - \frac{t^2}{10} + 10$. What is the velocity of the particle when its acceleration is zero?

2

$a(t)$

$v(t) = s'(t)$ Y_2

$a(t) = v'(t)$ Y_3

(A) – 5.19 (B) 0.74 (C) 1.32 (D) 2.55 (E) 8.13

Focus on when $a(t) = 0$ $Y_3 = 0$ $a = 1.318..$ $v(a) = 2.554..$

window → look at choices b/w $0, \pi$

$a(t)$

$a = 1.318116...$ ← store

Go to table

look at Y_2 when $x = 1.318116...$

$$\frac{2x \cdot 2e^{2x} - e^{2x}\,2}{(2x)^2} = \frac{\cancel{2}e^{2x}(2x-1)}{\cancel{4}x^2}$$

2

2. If $f(x) = \frac{e^{2x}}{2x}$, then $f'(x) =$

(A) 1 (B) $\frac{e^{2x}(1-2x)}{2x^2}$ (C) e^{2x} (D) $\frac{e^{2x}(2x+1)}{x^2}$ (E) $\frac{e^{2x}(2x-1)}{2x^2}$

3. $\lim\limits_{h \to 0} \frac{\ln(e+h)-1}{h}$ is

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

$$\frac{\ln\overset{e+h}{(x+h)} - \overset{\overset{1}{\ln e}}{\ln x}}{h}$$

$f(x) = \ln x$

$x = e$

(A) $f'(e)$, where $f(x) = \ln x$

(B) $f'(e)$, where $f(x) = \frac{\ln x}{x}$

(C) $f'(1)$, where $f(x) = \ln x$

(D) $f'(1)$, where $f(x) = \ln x$

(E) $f'(0)$, where $f(x) = \ln x$

4. If $f(x) = e^x$, then $\ln(f'(2)) =$

(A) 2 (B) 0 (C) $\frac{1}{e^2}$ (D) $2e$ (E) e^2

$f'(x) = e^x$

$f'(2) = e^2$

$\ln(e^2) = 2$

$y = \ln\left(\frac{x}{2}\right)$

$y' = \frac{2}{x} \cdot \frac{1}{2} = \frac{2}{2x}$

$= \frac{1}{x}$

5. The slope of the tangent line to the graph of $y = \ln\left(\frac{x}{2}\right)$ at $x = 4$ is

(A) $\frac{1}{8}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) 1 (E) 4

✓

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

6. If $f(x) = x\ln(x^2)$, then $f'(x) =$

$2 + \ln(x^2)$

(A) $\ln(x^2)+1$ (B) $\ln(x^2)+2$ (C) $\ln(x^2)+\frac{1}{x}$ (D) $\frac{1}{x^2}$ (E) $\frac{1}{x}$

✓

7. The position of a particle moving along a straight line at any given time t is given by
$x(t) = \frac{4}{3}t^3 - 6t^2 + 4.$ $8t$

$\frac{4}{3}(3)^3 - 6(3)^2 + 24$

$36 - 54 + 24$

(a) What is the average velocity of the particle for $0 \le t \le 3$?
(b) When is the particle at rest? $t = 2,\ t = 1$
(c) During what time interval(s) is the particle moving to the left? Right? $\rightarrow$ $0 < t < 1$, $t > 2$

$\leftarrow$ $1 < t < 2$

(a) $\frac{x(3) - x(0)}{3 - 0} = \frac{6 - 0}{3} = 2$ units

(b) $v(t) = \frac{4}{3} \cdot 3t^2 - 12t + 8$

$v(t) = 4t^2 - 12t + 8$

$4t^2 - 12t + 8 = 0$

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

$(t-2)(t-1) = 0$

$t = 2$ | $t = 1$

0 + 1 − 2 +

Name: Key

Set E

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

$\frac{\sqrt{9}}{2} = 2$

$v(t)$: $-$ $+$; 0, $\sqrt{3}/2$

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

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

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

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

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

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

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

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) $-\pi^2$

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

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

$$\frac{\overset{36}{v(3)} - \overset{0}{v(0)}}{3} = 12$$

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) $\frac{-\sqrt{2}}{\pi}$

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

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

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

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

$a(3/2) = -\pi^2 \overset{-1}{\sin\left(\frac{3\pi}{2}\right)} = \pi^2$

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

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

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

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