Lesson 1
HW p. 113 – 114 # 5 – 12, 31, 33, 41, 43,45, 47, 49,58, 63, 67
Power rule-Tangent line equation
http://study.com/academy/lesson/power-rule-for-derivatives-examples-lesson-quiz.html

Using the limit definition- we found derivatives now the short cut

Power rule $\mathbf{f(x)} = ax^n$
$$\mathbf{f'(x)} = nax^{n-1}$$

Sum and Difference Rules for Derivatives
$dy/dx[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Constant Multiple Rule
$dy/dx[c \cdot f(x)] = c \cdot f'(x)$

Use the power rule to find the derivative- REWRITE when necessary

$F(x) = x^3$ $\qquad$ $F(x) = 5x^3$ $\qquad$ $G(x) = \sqrt[3]{x}$

$F(x) = \dfrac{1}{x^2}$ $\qquad$ $F(x) = \dfrac{2}{x}$ $\qquad$ $F(x) = \dfrac{4x^2}{5}$

$G(x) = 2\sqrt{x}$ $\qquad$ $f(x) = \dfrac{1}{2\sqrt[3]{x^2}}$ $\qquad$ $f(x) = -\dfrac{3x}{2}$

$F(x) = x^3 - 4x + 5$ $\qquad$ $G(x) = \dfrac{x^4}{2} + 3x^3 - 2x$ $\qquad$ $F(x) = \dfrac{x^3 - 3x^2}{x}$

AP Calculus AB
Graphing Calculator Worksheet
Finding derivatives on the Graphing Calculator! MATH #8 OR 2ND CALC #6

In 1-3, Use a graphing calculator to find the value of the derivative of each of the following at the given point.

1. f(x) = 3lnx at the point (1,0)

2. $f(x)=\ln(\sqrt{1+\sin^2 x})$ *at the point* $(\frac{\pi}{6}, \ln\frac{\sqrt{5}}{2})$

3. $f(x)=xe^{-x}$ *at* $(1,\frac{1}{e})$

In 4-6; Use your graphing Calculator to find the derivative and then write the equation of the tangent line at the given x value.

4. y = 4cosx – x when x = 0.

5. $y=\frac{1}{\sqrt{2x+2}}+4$ *when* $x=1$.

6. y = 3^x when x = 3.

Name________________________ **AP Calculus AB 3.3 Worksheet**

Remember: **SHOW ALL WORK!**

$\frac{d}{dx}(\sin x) = \cos x$ $\frac{d}{dx}(\cos x) = -\sin x$ $\frac{d}{dx}(\tan x) = \sec^2 x$

$\frac{d}{dx}(\ln x) = \frac{1}{x}$ $\frac{d}{dx}(e^x) = e^x$

$(f \cdot g)' = f' \cdot g + g' \cdot f$ $\left(\frac{f}{g}\right)' = \frac{g \cdot f' - f \cdot g'}{g^2}$

Find the derivative of each:

1. $f(x) = \sin x + x^2$

2. $f(x) = e^x (\cos x)$

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

4. $G(x) = (\ln x)(\tan x)$

5. $f(x) = \frac{\cos x}{x} + \tan x$

6. $y = (\ln x)(e^x)$

7. $h(x) = (3x^2 + 2x + 1)\cos x$

8. $h(x) = (x^2 + e^x)\tan x$

9. $f(x) = (x^2 + e^x)(\cos x + \ln x)$

10. $f(x) = \frac{\sin x}{\ln x}$

3

11. $y = x^5 + 5x^4 - 10x - 7$

12. $y = \frac{1}{2x^2} + \frac{4}{\sqrt{x}}$

13. $y = \frac{2}{\sqrt[3]{x}} + \frac{4}{x^2}$

14. $f(x) = \frac{2x+2}{2x+3}$

15. $h(x) = \sqrt[3]{27x^2}$

16. $y = \frac{x^2+3x+2}{x^2-1}$

17. $y = \frac{x^2+3x+2}{x^2}$

18. $f(x) = 2\sqrt[3]{x}(\sqrt{x}+3)$

19. Find the slope of the curve $y = x^2 - 4x$ at the points where it crosses the x-axis.

20. A population of 5,000 bacteria is introduced into a culture and grows according to the equation $P(t) = 500\left(1 + \frac{4t}{50+t^2}\right)$, where t is hours. Find the rate at which the population is growing when $t = 2$.

To live a creative life, we must lose our fear of being wrong.
~Anonymous

AP Calculus AB **Section 3.3 DAY 3**

1. Solve for a and b in order for $g(x)$ to be both continuous and differentiable at $x = 0$.

$$g(x)=\begin{cases} ax+b & ;x>0 \\ 1-x+x^2 & ;x\le 0 \end{cases}$$

2. Solve for a and b in order for $f(x)$ to be both continuous and differentiable at $x = 1$.

$$f(x)=\begin{cases} x^2+2 & ;x\le 1 \\ a\left(x-\frac{1}{x}\right)+b & ;x>1 \end{cases}$$

3. For $a-d$, find $f'(2)$ given the following information:

$$g(2)=3 \quad g'(2)=-2$$
$$h(2)=-1 \quad h'(2)=4$$

a) $f(x)=2g(x)+h(x)$

b) $f(x)=4-h(x)$

c) $f(x)=g(x)h(x)$

d) $f(x)=\dfrac{g(x)}{h(x)}$

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

A) $13x-y=8$ B) $13x+y=18$ C) $x-13y=64$ D) $x+13y=66$ E) $-2x+3y=13$

8. When $x=8$, the rate at which $\sqrt[3]{x}$ is increasing is $\frac{1}{k}$ times the rate at which x is increasing. What is the value of k?

A) 3 B) 4 C) 6 D) 8 E) 12

5

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~Anonymous

9. Let $f(x)=\sqrt{x}$. If the rate of change of f at $x=c$ is twice its rate of change at $x=1$, then $c=$

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

10. What is the instantaneous rate of change at $x=2$ of the function f given by $f(x)=\dfrac{x^2-2}{x-1}$?

A) -2 B) $\frac{1}{6}$ C) $\frac{1}{2}$ D) 2 E) 6

11. Which of the following is an equation of the tangent line to $f(x)=x^4+2x^2$ at the point where $f'(x)=1$?

A) $y=8x-5$ B) $y=x+7$ C) $y=x+.763$ D) $y=x-.122$ E) $y=x-2.146$

12. 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) $(2,2)$

AP Calculus AB Review Sheet for Chapter 3 test

1. A spring is bobbing up and down so that its position at any time $t \geq 0$ is given by $s(t) = -4\sin t$.

   a) What is the initial position of the spring?

   b) Which way is the particle moving to start? Justify your response.

   c) At $t = \frac{5\pi}{4}$, is the spring moving up or down? Justify your response.

   d) Is the spring speeding up or slowing down at $t = \frac{5\pi}{4}$? Justify your response.

2. If $y = \sec x$, find $\frac{d^2y}{dx^2}$.

3. If $x(t) = t^2 - 8t + 12$ is a position of a particle moving along the x axis at time t, then

   a) Find the average velocity for the first 3 seconds.
   b) Find the velocity at $t = 4$ seconds.
   c) When is the object stopped?
   d) When is the acceleration of the object 0?
   e) When does the object change direction?
   f) When does the object slow down?
   g) When is the object moving left?

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

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

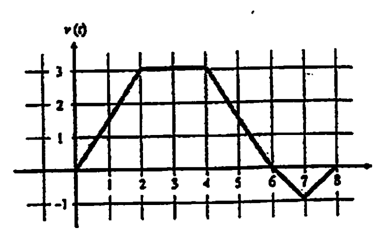
5. An equation of the line tangent to the graph of $y = x + \cos x$ at the point (0, 1) is

A) $y = 2x + 1$ B) $y = x + 1$ C) $y = x$ D) $y = x - 1$ E) $y = 0$

6. If $y = \tan x - \cot x$, then $\frac{dy}{dx} =$

A) $\sec x \csc x$ B) $\sec x - \csc x$ C) $\sec x + \csc x$ D) $\sec^2 x - \csc^2 x$ E) $\sec^2 x + \csc^2 x$

7. A bug begins to crawl up a vertical wire and it's velocity at time t is given in the graph below.
Find:
a) When does the particle change direction?
b) When is the particle moving down?
c) Is the particle speeding up or slowing down at t = 6.5?



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

A) -5.19　　B) 0.74　　C) 1.32　　D) 2.55　　E) 8.13

9. If $f(x) = \frac{x}{\tan x}$, then find $f'(2)$.

10. [Calculator]. Find the equation of the tangent line to the graph of $f(x) = (4-\sin x)^2$ at $x = 0$.

11. Find $\lim_{x \to \frac{\pi}{4}} \frac{\sec x - \sec(\frac{\pi}{4})}{x - \frac{\pi}{4}}$. This is a non-calculator question!! THINK!

12. Find y′ if $y = 4e^x + 10\ln x - \csc x + \sqrt[3]{x^2} + \frac{8}{x^2} + 4x - 100$

13. Given the data in the table find the following: (remember: v(t)=s'(t))

t	1	2	3	4	5	6	7
S(t)	45	56	78	90	35	30	25

a) v(3)　　b) v(4.5)　　c) Find the average velocity on the interval [0,5].

14.

x	f(x)	g(x)	f′(x)	g′(x)
-1	0	-1	2	1

Given the functions f and g and their derivatives at x = -1 find h'(-1).

a) $h(x) = \frac{f(x)}{g(x)}$　　b) $h(x) = f(x)g(x)$　　c) $h(x) = 3f(x) - 4g(x)$

Also do in the book: page 149; 61

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Name KEY **AP Calculus AB 3.3 Worksheet**

Remember: **SHOW ALL WORK!**

$\frac{d}{dx}(\sin x) = \cos x \quad \frac{d}{dx}(\cos x) = -\sin x \quad \frac{d}{dx}(\tan x) = \sec^2 x$

$\frac{d}{dx}(\ln x) = \frac{1}{x} \quad \frac{d}{dx}(e^x) = e^x$

$(f \cdot g)' = f' \cdot g + g' \cdot f \quad \left(\frac{f}{g}\right)' = \frac{g \cdot f' - f \cdot g'}{g^2}$

Find the derivative of each:

1. $f(x) = \sin x + x^2$

$f'(x) = \cos x + 2x$

2. $f(x) = e^x(\cos x)$

$f'(x) = (e^x)'\cos x + e^x(\cos x)'$

$f'(x) = e^x \cos x - e^x \sin x$

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

$= \frac{x^2e^x - 3e^x - 2xe^x - 2x}{(x^2-3)^2}$

4. $G(x) = (\ln x)(\tan x)$

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

5. $f(x) = \frac{\cos x}{x} + \tan x$

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

$= \frac{-x\sin x - \cos x}{x^2} + \sec^2 x$

6. $y = (\ln x)(e^x)$

$y' = \frac{1}{x}e^x + \ln x \cdot e^x$

7. $h(x) = (3x^2+2x+1)\cos x$

$h'(x) = (6x+2)\cos x + (3x^2+2x+1)(-\sin x)$

$(6x+2)\cos x - (3x^2+2x+1)\sin x$

8. $h(x) = (x^2 + e^x)\tan x$

$h'(x) = (2x+e^x)\tan x + (x^2+e^x)\sec$

9. $f(x) = (x^2 + e^x)(\cos x + \ln x)$

$f'(x) = (2x+e^x)(\cos x + \ln x) + (x^2+e^x)(-\sin x + 1/x)$

10. $f(x) = \frac{\sin x}{\ln x}$ $\quad f'(x) = \frac{\ln x(\cos x) - \sin}{(\ln x)^2}$

$\boxed{f'(x) = \frac{x\ln x\cos x - \sin x}{x(\ln x)^2}}$

3

11. $y = x^5 + 5x^4 - 10x - 7$

$y' = 5x^4 + 20x^3 - 10$

12. $y = \frac{1}{2x^2} + \frac{4}{\sqrt{x}} = \frac{1}{2}x^{-2} + 4x^{-1/2}$

$y' = -x^{-3} - 2x^{-3/2}$

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

13. $y = \frac{2}{\sqrt[3]{x}} + \frac{4}{x^2} = 2x^{-1/3} + 4x^{-2}$

$y' = -\frac{2}{3}x^{-4/3} - 8x^{-3}$

$\boxed{\frac{-2}{3x^{4/3}} - \frac{8}{x^3}}$

14. $f(x) = \frac{2x+2}{2x+3}$

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

$f'(x) = \frac{\cancel{4x}+6-\cancel{4x}-4}{(2x+3)^2} = \frac{2}{(2x+3)^2}$

15. $h(x) = \sqrt[3]{27x^2} = 3x^{2/3}$

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

16. $y = \frac{x^2+3x+2}{x^2-1}$

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

$y' = \frac{-3x^2-6x-3}{(x^2-1)^2}$

17. $y = \frac{x^2+3x+2}{x^2} = \frac{x^2}{x^2} + \frac{3x}{x^2} + \frac{2}{x^2}$

$= 1 + \frac{3}{x} + \frac{2}{x^2}$

$= 1 + 3x^{-1} + 2x^{-2}$

$y' = -3x^{-2} - 4x^{-3} = \boxed{\frac{-3}{x^2} - \frac{4}{x^3}}$

18. $f(x) = 2\sqrt[3]{x}(\sqrt{x}+3) = 2x^{1/3}(x^{1/2}+3)$

$= 2x^{5/6} + 6x^{1/3}$

$f'(x) = \frac{10}{6}x^{-1/6} + 2x^{-2/3}$

$f'(x) = \frac{5}{3x^{1/6}} + \frac{2}{x^{2/3}}$

19. Find the slope of the curve $y = x^2 - 4x$ at the points where it crosses the x-axis.

☆ $y = x^2 - 4x$ crosses the x-axis when $x=0$ and $x=4$

$y' = 2x - 4$

$y'|_{x=0} = 2(0) - 4 = \boxed{-4}$ $y'|_{x=4} = 2 \cdot 4 - 4 = 4$

20. A population of 5,000 bacteria is introduced into a culture and grows according to the equation $P(t) = 500\left(1 + \frac{4t}{50+t^2}\right)$, where t is hours. Find the rate at which the population is growing when t = 2.

Need $P'(2)$

$P(t) = 500 + \frac{2000t}{50+t^2}$

$P'(t) = 0 + \frac{(50+t^2)(2000) - 2000t(2t)}{(50+t^2)^2}$

$P'(2) = \frac{(54)(2000) - 4000(4)}{(54)^2} = 31.55$ Bacteria per ho

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~Anonymous

AP Calculus AB **Section 3.3 DAY 3**

1. Solve for a and b in order for $g(x)$ to be both continuous and differentiable at $x = 0$.

$$g(x)=\begin{cases} ax+b & ;x>0 \\ 1-x+x^2 & ;x\le 0\end{cases} \qquad g'(x)=\begin{cases} a & x>0 \\ -1+2x & x\le 0\end{cases}$$

Cont.

$\lim_{x\to 0^+} g(x) = \lim_{x\to 0^-} g(x) = g(c)$

$a(0)+b = 1-0+0^2 = 1-0+0^2$

$b=1$

Dif.

$\lim_{x\to 0^+} g'(x) = \lim_{x\to 0^-} g'(x)$

$a = -1+2(0)$

$a=-1$

2. Solve for a and b in order for $f(x)$ to be both continuous and differentiable at $x = 1$.

$$f(x)=\begin{cases} x^2+2 & ;x\le 1 \\ a\left(x-\frac{1}{x}\right)+b & ;x>1\end{cases} \qquad f'(x)=\begin{cases} 2x & x\le 1 \\ a\left(1+\frac{1}{x^2}\right) & x>1\end{cases}$$

Cont.

$f(1)=1^2+2=3$

$\lim_{x\to 1^-} f(x) = \lim_{x\to 1^+} f(x)$

$1^2+2 = a\left(1-\frac{1}{1}\right)+b$

$3=b$

Dif.

$\lim_{x\to 1^-} f'(x) = \lim_{x\to 1^+} f'(x)$

$2(1) = a\left(1+\frac{1}{1^2}\right)$

$2 = 2a$

$a=1$

3. For $a-d$, find $f'(2)$ given the following information:

$g(2)=3 \quad g'(2)=-2$

$h(2)=-1 \quad h'(2)=4$

a) $f(x)=2g(x)+h(x)$

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

$f'(2) = 2g'(2)+h'(2) = 2(-2)+4 = 0$

b) $f(x)=4-h(x)$

$f'(x) = 0-h'(x) \qquad f'(2) = -h'(2) = -4$

c) $f(x)=g(x)h(x)$

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

Product Rule

$f'(2) = g'(2)h(2)+h'(2)g(2) = (-2)(-1)+(4)(3) = 2+12 = 14$

d) $f(x)=\dfrac{g(x)}{h(x)}$

$f'(x) = \dfrac{g'(x)h(x)-h'(x)g(x)}{(h(x))^2}$

Quotient Rule

$f'(2) = \dfrac{g'(2)h(2)-h'(2)g(2)}{(h(2))^2} = \dfrac{(-2)(-1)-(4)(3)}{(-1)^2} = -10$

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

A) $13x-y=8$ B) $13x+y=18$ C) $x-13y=64$ D) $x+13y=66$ E) $-2x+3y=13$

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

$y'\Big|_{x=1} = \dfrac{2(1)-3(5)}{1^2} = -13$

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

$y-5=-13x+13$

$y=-13x+18$

8. When $x = 8$, the rate at which $\sqrt[3]{x}$ is increasing is $\frac{1}{k}$ times the rate at which x is increasing. What is the value of k?

y' $\quad$ → rate $\quad \frac{d}{dx}(x)=1$

A) 3 B) 4 C) 6 D) 8 E) 12

$\frac{1}{12} = \frac{1}{k}(1)$

Rate = derivative $= \frac{1}{3}x^{-2/3} = \dfrac{1}{3\sqrt[3]{x^2}}\Bigg|_{x=8} = \dfrac{1}{3(\sqrt[3]{8})^2} = \dfrac{1}{3(2)^2} = \dfrac{1}{12}$

$k=12$

(5)

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$f'(x) = \frac{1}{2}x^{-1/2} = \frac{1}{2\sqrt{x}}$ twice rate at $x = 1$

$f'(c) = \frac{1}{2\sqrt{c}} = 2f'(1) = 2\frac{1}{2\sqrt{1}} = 1$

$f'(x)$

9. Let $f(x) = \sqrt{x}$. If the rate of change of f at $x = c$ is twice its rate of change at $x = 1$, then $c =$

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

$\frac{1}{2\sqrt{c}} = 1$

$1 = 2\sqrt{c}$

$(\sqrt{c})^2 = \left(\frac{1}{2}\right)^2$

$c = \frac{1}{4}$

$f'(x)$

10. What is the instantaneous rate of change at $x = 2$ of the function f given by $f(x) = \frac{x^2 - 2}{x - 1}$?

A) -2 B) $\frac{1}{6}$ C) $\frac{1}{2}$ D) 2 E) 6

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

11. Which of the following is an equation of the tangent line to $f(x) = x^4 + 2x^2$ at the point where $f'(x) = 1$? ← slope

A) $y = 8x - 5$ B) $y = x + 7$ C) $y = x + .763$ D) $y = x - .122$ E) $y = x - 2.146$

$y - .1152 = 1(x - .2367)$

$f'(x) = 4x^3 + 4x = 1$

$4x^3 + 4x - 1 = 0$ ← use graphing calc. to solve

$x \approx .2367$

$f(.2367) \approx .1152$

12. 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) $(2,2)$

$\frac{-4y}{-4} = \frac{-2x + 3}{-4}$

$y = \frac{1}{2}x - \frac{3}{4}$

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

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

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

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

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

KEY

AP Calculus AB Review Sheet for Chapter 3 test

1. A spring is bobbing up and down so that its position at any time $t \geq 0$ is given by $s(t) = -4\sin t$.

   a) What is the initial position of the spring? $s(0) = 0$

   b) Which way is the particle moving to start? Justify your response. $v(t) = -4\cos t$

   Down since $v(t) < 0$

   $0 \; - \; \pi/2 \; + \; \frac{3\pi}{2} \; - \; 2\pi$

   c) At $t = \frac{5\pi}{4}$, is the spring moving up or down? Justify your response.

   ~~up~~ since $v(5\pi/4) > 0$

   d) Is the spring speeding up or slowing down at $t = \frac{5\pi}{4}$? Justify your response. $a(t) = 4\sin t$

   $v(5\pi/4) = +$ $\quad a(5\pi/4) = -$ slowing down since the are different signs

2. If $y = \sec x$, find $\frac{d^2y}{dx^2}$.

$\frac{dy}{dx} = \sec x \tan x \qquad \frac{d^2y}{dx^2} = \sec x \tan^2 x + \sec^3 x$

3. If $x(t) = t^2 - 8t + 12$ is a position of a particle moving along the x axis at time t, then

$v(t) = 2t - 8$

$a(t) = 2$

   a) Find the average velocity for the first 3 seconds. -5 m/s
   b) Find the velocity at $t = 4$ seconds. 0 m/s
   c) When is the object stopped? $t = 4$ sec
   d) When is the acceleration of the object 0? Never
   e) When does the object change direction? $t = 4$
   f) When does the object slow down? $\rightarrow 0 < t < 4$ $\quad v(t)$ & $a(t)$ Diff sign
   g) When is the object moving left? $0 < t < 4$ since $v(t) < 0$

$v(t)$: $- \; 4 \; +$

$a(t)$: $+$

4. $\lim_{h \to 0} \frac{\sin(x+h) - \sin x}{h} =$ asking for the deriv of $\sin x$ which is $\cos x$

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

5. An equation of the line tangent to the graph of $y = x + \cos x$ at the point (0, 1) is $\quad y' = 1 - \sin x \quad m_T = 1 - \sin(0)$

   A) $y = 2x + 1$ B) $y = x + 1$ C) $y = x$ D) $y = x - 1$ E) $y = 0$

   $y - 1 = 1(x - 0)$

   $y = x + 1$

6. If $y = \tan x - \cot x$, then $\frac{dy}{dx} = \sec^2 x + \csc^2 x$

   A) $\sec x \csc x$ B) $\sec x - \csc x$ C) $\sec x + \csc x$ D) $\sec^2 x - \csc^2 x$ E) $\sec^2 x + \csc^2 x$

7. A bug begins to crawl up a vertical wire and it's velocity at time t is given in the graph below.

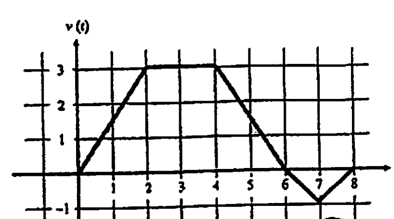
Find:

a) When does the particle change direction? $t = 6$

b) When is the particle moving down? $6 < t < 8$

c) Is the particle speeding up or slowing down at t = 6.5?

Speeding up $v(t)$ & $a(t)$ have the same sign!



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$s(t) = \ldots$
$v(t) = 4\sin t - t$
$a(t) = 4\cos t - 1$

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

A) -5.19 B) 0.74 C) 1.32 D) 2.55 E) 8.13

$4\cos t - 1 =$
USE CALC
$t \approx 1.3$
$v(1.318) = \boxed{2.554}$

9. If $f(x) = \dfrac{x}{\tan x}$, then find $f'(2)$.

CALC!

$\dfrac{\tan x(1) - x \cdot \sec^2 x}{\tan^2 x} = \dfrac{\tan x - x\sec^2 x}{\tan^2 x} \approx \boxed{-2.876}$

10. [Calculator]. Find the equation of the tangent line to the graph of f(x) = (4-sinx)² at x = 0.

USE CALC TO FIND $f'(0)$ MATH #8

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11. Find $\lim\limits_{x \to \frac{\pi}{4}} \dfrac{\sec x - \sec(\frac{\pi}{4})}{x - \frac{\pi}{4}}$. This is a non-calculator question!! THINK!

They want the derivative of $y = \sec x$ at $x = \pi/4$!

$y' = \sec x \tan x$

$y'(\pi/4) = \sec \pi/4 \tan \pi/4 = \sqrt{\ldots}$

12. Find y' if $y = 4e^x + 10\ln x - \csc x + \sqrt[3]{x^2} + \frac{8}{x^2} + 4x - 100$

$y' = 4e^x + \frac{10}{x} + \csc x \cot x + \frac{2}{3}x^{-1/3} - 16x^{-3} + 4$

13. Given the data in the table find the following: (remember: v(t)=s'(t))

t	1	2	3	4	5	6	7
S(t)	45	56	78	90	35	30	25

a) v(3) b) v(4.5) c) Find the average velocity on the interval [0,5].

$v(3) \doteq s'(3) \approx \frac{90-56}{4-2} = 17$

$s'(4.5) \approx \frac{35-90}{5-4} = -55$

$\frac{s(5)-s(0)}{5-0} = \frac{35-45}{5} = \ldots$

14.

x	f(x)	g(x)	f'(x)	g'(x)
-1	0	-1	2	1

Given the functions f and g and their derivatives at x = -1 find h'(-1).

$h'(-1) = 3f'(-1) - 4g'(-1) = 2$

a) $h(x) = \dfrac{f(x)}{g(x)}$ b) $h(x) = f(x)g(x)$ c) $h(x) = 3f(x) - 4g(x)$

b) $h'(-1) = f'(-1)g(-1) + f(-1)g'(-1) = (2)(-1) + 0(1) = -2$

Also do in the book: page 149; 61

a) $h'(-1) = \dfrac{g(-1) \cdot f'(-1) - f(-1) \cdot g'(-1)}{g^2(-1)} = \dfrac{(-1)(2) - (0)}{(-1)^2} = -2$

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