3.5 Trig Derivatives

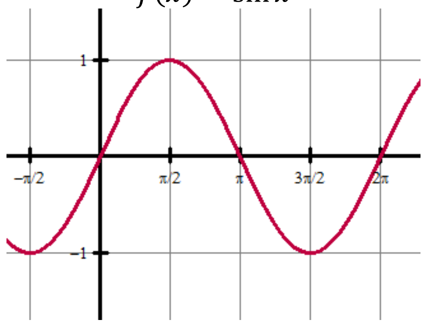
NOTES

CALCULUS

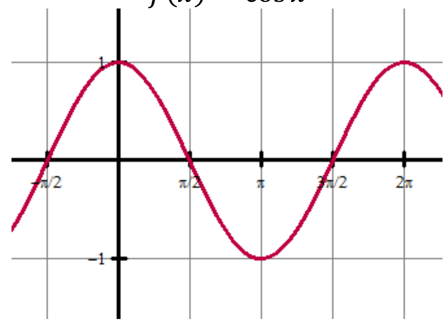
Write your questions here!

Sine and Cosine

$f(x) = \sin x$



$f(x) = \cos x$



The derivative of trig functions

$\frac{d}{dy}\sin x =$	$\frac{d}{dy}\csc x =$
$\frac{d}{dy}\cos x =$	$\frac{d}{dy}\sec x =$
$\frac{d}{dy}\tan x =$	$\frac{d}{dy}\cot x =$

The "co's" are always negative and friends!

Find the derivative of the following.

$f(x) = \sin x + \tan x$

$y = \cos 3x$

$y = 3\cot(x)$

$f(x) = \sin^2(x)$

Evaluate the derivative at the given point.

$$f(\theta) = 4\cos^3(2x) \text{ at } \theta = \frac{\pi}{6}$$

Find the equation for the line that is tangent and normal to

$$y = \pi + 2\tan x \text{ at } x = \pi$$

BRING THE PAIN!

$$y = x^2 \csc(2x)$$

$$y = \sqrt{4 - \cos(x^2)}$$

SUMMARY:

Now, summarize your notes here!

Warm Up! Find the derivative of the following.

1. $y = \cos 2x$

2. $f(x) = 2\sin x$

3. $y = \cos^2 x$

4. $f(x) = \csc(\pi x)$

5. $y = -3\tan(5x^3)$

6. $f(\theta) = 5\sec(4\theta)$

Warm Up! Evaluate the derivative at a point.

7. $f(x) = 3\sin(2x)$

$f'\left(\frac{\pi}{3}\right) =$

8. $f(\theta) = -2\csc\theta + 4$

$f'\left(\frac{\pi}{2}\right) =$

9. $y = 4\sin^3 x$

$\left.\frac{dy}{dx}\right|_{x=\frac{\pi}{4}}$

Find the derivative of the following.

10. $f(x) = 2\sin x + \cos x$

11. $g(x) = 2x\cos(4x)$

12. $y = 5 - \csc\left(\frac{x^2}{2}\right)$

13. $h(x) = \sqrt{\tan(2x)}$

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

15. $y = \sec(\pi x + 1)$

16. $r = \theta \sin\theta$

17. $s = t\cos(t^2)$

Evaluate the derivative at a point.

18. $f(x) = \cos(\tan x)$

$f'(\pi) =$

19. $y = \frac{\sin x}{x}$

$\left.\frac{dy}{dx}\right|_{x=\frac{\pi}{2}}$

Write the equation of the tangent line and the normal line at the point given.

20. $f(x) = \tan^2 x$ at $x = \frac{\pi}{4}$

Particle Motion

21. The position of a particle moving along a coordinate line is $s(t) = 2\sin\pi t + 5\cos\pi t$, with s in meters and t in seconds. Find the particle's velocity and acceleration at $t = 1$.

MULTIPLE CHOICE

1. If $f(x) = \frac{\sin\sqrt{x}}{\sqrt{x}}$, then $f'(x)$ is

   (A) $\frac{\cos\sqrt{x}}{2x} - \frac{\sin\sqrt{x}}{2\sqrt{x^3}}$

   (B) $\frac{\cos\sqrt{x} - \sin\sqrt{x}}{2x}$

   (C) $\frac{\sqrt{x}\cos\sqrt{x} - \frac{\sin\sqrt{x}}{2\sqrt{x}}}{x}$

   (D) $\cos\sqrt{x}$

   (E) $\frac{\frac{\cos\sqrt{x}}{2} + \frac{\sin\sqrt{x}}{2\sqrt{x}}}{x}$

2. What is $\lim_{h\to 0}\frac{\cos\left(\frac{\pi}{2}+h\right) - \cos\left(\frac{\pi}{2}\right)}{h}$?

   (A) -1

   (B) $-\frac{\sqrt{2}}{2}$

   (C) 0

   (D) 1

   (E) The limit does not exist.

You are allowed to use a graphing calculator for 3-5

3. Let $f(x) = \sqrt{2x}$. If the rate of change of f at $x = c$ is four times its rate of change at $x = 1$, then $c =$

   (A) $\frac{1}{16}$
   (B) $\frac{1}{2\sqrt{2}}$
   (C) $\frac{1}{\sqrt{2}}$
   (D) 1
   (E) 32

4. If $f(x) = -\frac{1}{|x|}$, then $f'(2) =$
   (A) 0.050
   (B) -0.250
   (C) 0.250
   (D) -0.050
   (E) -0.500

5. At time $t \geq 0$, the position of a particle moving along the x-axis is given by $x(t) = \frac{t^3}{3} + 2t + 2$. For what value of t in the interval $[0,3]$ will the instantaneous velocity of the particle equal the average velocity of the particle from time $t = 0$ to time $t = 3$
(A) 1
(B) $\sqrt{3}$
(C) $\sqrt{7}$
(D) 3
(E) 5

You are allowed to use a graphing calculator on the Free Response

<u>FREE RESPONSE</u>

Your score: ____ out of 5

1. The rate of change, in kilometers per hour, of the altitude of a hot air balloon is given by $r(t) = t^3 - 4t^2 + 6$ for time $0 \leq t \leq 4$, where t is measured in hours. Assume the balloon is initially at ground level.

(a) For what values of t, $0 \leq t \leq 4$, is the altitude of the balloon decreasing?

(b) Find the value of $r'(2)$ and explain the meaning of the answer in the context of the problem. Indicate units of measure.

(c) When does the hot air balloon have an acceleration of zero? Justify.