1. 0/2 points SCalc8 2.5.001. [335440

Write the composite function in the form $f(g(x))$. [Identify the inner function $u = g(x)$ and the outer function $y = f(u)$.]

$$y = \sqrt[3]{1 + 7x}$$

$(g(x), f(u)) = ($

Find the derivative dy/dx.

$\frac{dy}{dx} =$

$g(x) = 1+7x$

$f(u)$ (or $f(g)$)

$= \sqrt[3]{u}$ (or $\sqrt[3]{g}$)

3. 0/1 points

Find the derivative of the function.

$$F(x) = (3x^6 + 2x^3)^4$$

$F'(x) =$

§2.5

21. 0/2 points SCalc8 2.5.078. [335

A model for the length of daylight (in hours) in Philadelphia on the tth day of the year is

$$L(t) = 12 + 2.8 \sin\left[\frac{2\pi}{365}(t - 80)\right].$$

Use this model to compare how the number of hours of daylight is increasing in Philadelphia on March 21 and May 21. (Assume there are 365 days in a year. Round your answers to four decimal places.)

March 21 $L'(t)$ = 0.0482

May 21 $L'(t)$ =

want # of hours of daylight is INCREASING on March 21st.

Let t = # of days into the year

March 21st : $\underset{J}{31} + \underset{F}{28} + \underset{Mar}{21} = \boxed{80 = t}$ on March 21st

This exercise wants $L'(80)$

$$L'(t) = 2.8\cos\left(\frac{2\pi}{365}(t-80)\right) \cdot \frac{2\pi}{365} \cdot 1$$

$$\frac{2\pi}{365}t - \frac{2\pi}{360}(80)$$

$$= \frac{(2\pi)(2.8)}{365}\cos\left(\frac{2\pi}{365}(t-80)\right)$$

So $L'(80) \approx$ 0.4819977769e-1 $= .4819977769 \times 10^{-1} \approx .0482$

$L'(80)$ By hand:

May 21st $\Rightarrow t = 31+28+31+30+21$

$= 59+61+21 = 141$

$L'(141) \approx .0239800299 \approx \boxed{.0240}$

units?

```
 -.3333333333
2π*2.8/365*cos(2
π/365*(80-80)
  .0481997777
2π*2.8/365*cos(2
π/365*(141-80)
  .0239800299
```

$\dfrac{\text{miles}}{\text{hr}}$

$$\frac{\;\frac{\text{miles}}{\text{hr}}\;}{\text{hr}} = \frac{\text{miles}}{\text{hour}^2}$$

$$\frac{\;\frac{32\text{ft}}{\text{sec}}\;}{\text{sec}} = \frac{32\text{ft}}{\text{sec}^2}$$

$$L = \frac{\text{Hours of sunlight}}{\text{day}} = L(t)$$

$$L'(141) \approx .0240 \quad \frac{\;\frac{\text{Hours of sun}}{\text{day}}\;}{\text{day}} = \frac{\text{Hour of sun}}{\text{day}^2}$$

20. 0/2 points SCalc8 2.5.077. [3354362]

A Cepheid variable star is a star whose brightness alternately increases and decreases. For a certain star, the interval between times of maximum brightness is 5.7 days. The average brightness of this star is 2.0 and its brightness changes by ±0.45. In view of these data, the brightness of the star at time t, where t is measured in days, has been modeled by the function

$$B(t) = 2.0 + 0.45 \sin\left(\frac{2\pi t}{5.7}\right).$$

(a) Find the rate of chang[redacted] after t days.

$\frac{dB}{dt} =$ [redacted]

(b) Find, correct to two decimal places, the rate of increase after five days.

$\frac{dB}{dt} =$ [redacted]

16. 0/2 points SCalc8 2.5.059. [3694806]

Find all points on the graph of the function $f(x) = 2\sin(x) + \sin^2(x)$ at which the tangent line is horizontal. (Use n as your arbitrary integer.)

$(x, y) = \left(\quad \right)$ ✗ $2\pi n + \frac{3\pi}{2}, -1$ (smaller y-value)

$(x, y) = \left(\quad \right)$ ✗ $2\pi n + \frac{\pi}{2}, 3$ (larger y-value)

$\Rightarrow f'(x) = 0$

99% of Calculus I : $f'(x) \underset{=}{\text{SET}} 0$!

$\boxed{f'(x) = 2\cos(x) + 2\sin(x)\cos(x)}$ $\underset{=}{\text{SET}}\ 0 \Rightarrow$

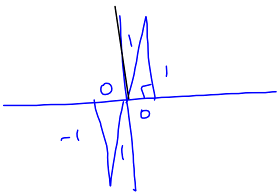
$g(x) = \sin^2(x) = (\sin(x))^2$ Scratch

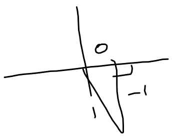
$\Rightarrow g'(x) = 2\sin(x)\cdot\cos(x)$

$\Rightarrow 2\cos(x)\left[1 + \sin(x)\right] = 0$

$\Rightarrow 2\cos(x) = 0$ OR $1 + \sin(x) = 0$

$\cos(x) = 0$ $\Rightarrow \sin(x) = -1$





$\mathbb{Z} = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$

$x = \frac{\pi}{2}, \frac{3\pi}{2}$ $x = \frac{3\pi}{2}$

$x \in \left\{ x + 2n\pi \mid x = \frac{\pi}{2}, \frac{3\pi}{2}, n \in \mathbb{Z} \right\}$

$= \left\{ x + n\pi \mid x = \frac{\pi}{2}, n \in \mathbb{Z} \right\}$

$= \left\{ x \mid x = \frac{\pi}{2} + n\pi, n \in \mathbb{Z} \right\}$

Prob'ly all the WebAssign wants

Nope!

Those are the x's! They also want the y-values!

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

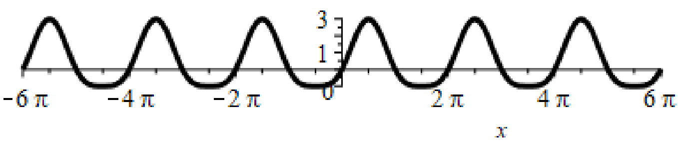
$f\left(\frac{\pi}{2}\right) = 2\sin\left(\frac{\pi}{2}\right) + \sin^2\left(\frac{\pi}{2}\right) = 3 = f\left(\frac{\pi}{2} + 2n\pi\right)$ $(n \in \mathbb{Z})$

$f\left(\frac{3\pi}{2}\right) = 2\sin\left(\frac{3\pi}{2}\right) + \sin^2\left(\frac{3\pi}{2}\right) = -1 = f\left(\frac{3\pi}{2} + 2n\pi\right)$

So, WebAssign's prob'ly looking for

$\left(\frac{\pi}{2} + 2n\pi, 3\right)$ silly!

$\left(\frac{3\pi}{2} + 2n\pi, -1\right)$



Some 2.4 Examples

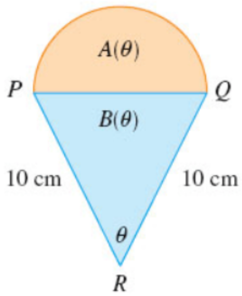
Section 2.4: The dreaded ice-cream-cone question.

23. 0/1 points SCalc8 2.4.056. [3354197

A semicircle with diameter *PQ* sits on an isosceles triangle *PQR* to form a region shaped like a two-dimensional ice-cream cone, as shown in the figure. If $A(\theta)$ is the area of the semicircle and $B(\theta)$ is the area of the triangle, find

$$\lim_{\theta \to 0^+} \frac{A(\theta)}{B(\theta)}.$$

0



Fall '19 TEST 2

§2.6 $x^2+2xy+4y^2=12$ Doesn't give y as a function of x.

Even if you solved for 'y' you wouldn't get a single-valued function of x. But it still "kind of" is; IMPLICITLY

(a) Find $\frac{dy}{dx}=y'$ $\qquad \frac{d}{dx}[y^2]=2y\cdot\frac{dy}{dx}=2yy'$

$$\frac{d}{dx}\left[x^2+2xy+4y^2=12\right]$$

Chain Rule!

$$=2x+2y+2xy'+8yy'=0$$

$f'=2 \quad g'=y'$

$$\frac{d}{dx}[2xy]=\frac{d}{dx}[fg], \text{ where } f=2x,\ g=y \Rightarrow$$

$$\frac{d}{dx}[fg]=f'g+fg'=2y+2xy'$$

$$\frac{d}{dx}[y^2]=2yy'$$

$$\frac{d}{dx}[4y^2]=4\cdot 2y\,y'=8yy'$$

$$\frac{d}{dy}[y^2] \quad \frac{d}{dx}[y]$$

$$2x+2y+2xy'+8yy'=0$$

$$\Rightarrow 2xy'+8yy'=-2x-2y$$

$$\Rightarrow (2x+8y)y'=-2x-2y$$

$$\Rightarrow \boxed{y'=\frac{-2x-2y}{2x+8y}}$$

(b) Find tangent line to the curve @ $(x,y)=(2,1)$

$$y=f'(x_1)(x-x_1)+f(x_1)$$

$$=\left(y'\Big|_{(x,y)=(2,1)}\right)(x-2)+1$$

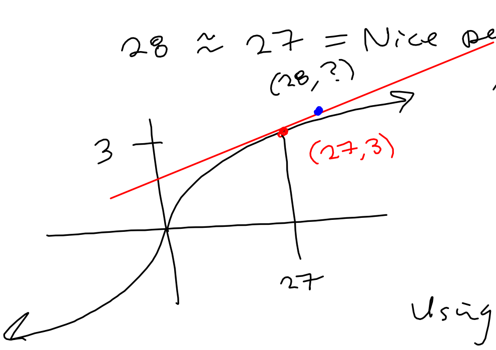
$$y'\Big|_{(x,y)=(2,1)}=\frac{-2(2)-2(1)}{2(2)+8(1)}=\frac{-4-2}{4+8}=\frac{-6}{12}=-\frac{1}{2}=m_{tan}$$

$$\boxed{y=-\tfrac{1}{2}(x-2)+1}$$ Mills likes

$$y=-\tfrac{1}{2}x+1+1=-\tfrac{1}{2}x+2$$ WebAssign Likes

$\sqrt[3]{28}$ using differentials or linear approximation

$28 \approx 27$ = Nice perfect cube!



$? = f'(27)(28-27) + 3$

$= f'(27)(28-27) + f(27)$

$= f'(27) + f(27)$

Using Linear Approx:

$L(x) = y = f'(27)\underbrace{(x-27)}_{\Delta x} + f(27)$

$f(x) = \sqrt[3]{x} = x^{\frac{1}{3}} \Rightarrow f'(x) = \frac{1}{3}x^{-2/3} \Rightarrow$

$f'(27) = \frac{1}{3}(27)^{-2/3} = \frac{1}{3}(27^{1/3})^{-2} = \frac{1}{3}(3)^{-2} = \frac{1}{3}\left(\frac{1}{9}\right)$

$= \frac{1}{27} = f'(27) \Rightarrow$

$\Rightarrow$ tangent line $= L_{27}(x) = y = \frac{1}{27}(x-27) + f(27)$

$= \frac{1}{27} + \sqrt[3]{27} = 3 + \frac{1}{27}$

```
        .0239800299
Ans*60
        1.438801796
1/27
        .037037037
28^(1/3)
        3.036588972
```

$\boxed{= 3.\overline{037} \approx \sqrt[3]{28}}$

$\cancel{3\frac{1}{27}}$ Bleah