Shelby Kroeger
12/7/10

# calculus

## answers

1. $$\frac{[4+3(3+h)-(3+h)^2]-[4+9-9]}{h}$$

$$\frac{[4+9+3h-(9+6h+h^2)]-4}{h}$$

$$\frac{\cancel{4}+\cancel{9}+3h-\cancel{9}-6h-h^2-\cancel{4}}{h} = \frac{-3h-h^2}{h}$$

$$\frac{\cancel{h}(-3-h)}{\cancel{h}} = \boxed{-3-h}$$

2. $g(x) = x^2+1$

$f(x) = x^{10}$

$$f(g(x)) = f(x^2+1)$$
$$= (x^2+1)^{10}$$ ✓

Cody
Lewis

1.4-1.5 Answers

1. $\lim_{x \to 2} \frac{x^2+x-6}{x-2} = \lim_{x \to 2} \frac{(x+3)(x-2)}{x-2} = \lim_{x \to 2} x+3 = 2+3 = \boxed{5}$

2. $\lim_{x \to 0} \frac{\sin 3x}{x} = 3 \lim_{x \to 0} \frac{\sin x}{x} = 3 \cdot 1 = \boxed{3}$

Taylor Bennett

## ANSWERS

1.) Find the limit

$$\lim_{x\to\infty}\left(\frac{x^3-2x+3}{5-2x^2}\right)$$

First divide the numerator and denominator by $x^2$ (the higest power of x that occurs in the denominator)

$$\lim_{x\to\infty}\left(\frac{x^3-2x+3}{5-2x^2}\right)=\frac{x-2/x+3/x^2}{5/x^2-2}$$

$$\lim_{x\to\infty} x-2/x+3/x^2=\infty \text{ and } \lim_{x\to\infty} 5/x^2-2=-2$$

$$\text{so } \lim_{x\to\infty}\left(\frac{\overbrace{x^3-2x+3}^{\infty}}{\underbrace{5-2x^2}_{-2}}\right)=\boxed{-\infty}$$

2.) $$g'(x)=\lim_{h\to0}\frac{g(x+h)-g(x)}{h} \qquad g(x)=1-x^3$$

$$g'(x)=\lim_{h\to0}\frac{1-(x+h)^3-(1-x^3)}{h}$$

$$=\lim_{h\to0}\frac{\cancel{1}-(\cancel{x^3}+3hx^2+3h^2x+h^3)\cancel{-1}\cancel{+x^3}}{h}$$

$$=\lim_{h\to0}\frac{-3\cancel{h}x^2-3h^2x-h^2}{h}$$

$$=\lim_{h\to0}-3x^2-3hx-h^2=-3x^2 \qquad g'(0)=0$$

$$y-g(a)=g'(a)(x-a) \qquad \text{point } (0,1)$$

$$y-1=0(x-0) \qquad g(a)=g(0)=1$$

$$y-1=0 \qquad g'(a)=g'(0)=0$$

$$\boxed{y=1}$$

Jacob coffey

# Section 2.2 Answers

#2 A) $f'(0) = -2$ B) $f'(1) = 0$

C) $f'(2) = 2$ D) $f'(3) = 2$

E) $f'(4) = -\frac{3}{2}$ F) $f'(5) = -1$

#28 It is not differentiable at $f(x) = 0$ because there is an asymptote. It is not differentiable at $f(x) = 3$ because it's a sharp point so there is no tangent line

Jacob coffey

Section 2.3 Answers

#6 $f'(t) = 3t^5 - 12t^3 + 1$

#27 $y' = 1 + \frac{1}{2\sqrt{x}}$

$y'(1) = 1 + \frac{1}{2\sqrt{1}} = \frac{2}{2} + \frac{1}{2} = \frac{3}{2}$

$\frac{3}{2}$ = slope put into $y - y_1 = m(x - x_1)$

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

Anna Kenneally

Calc Final Review

2.4 Solutions

#1. $y = \dfrac{x^2}{3x^2-2x-1} = \dfrac{(3x^2-2x-1)D_x(x^2) - (x^2)D_x(3x^2-2x-1)}{(3x^2-2x-1)^2}$

$= \dfrac{(3x^2-2x-1)(2x) - (x^2)(6x-2)}{(3x-2x-1)^2}$

$= \dfrac{2x(1-x)}{(3x^2-2x-1)^2}$

#2. $y = t^3 \cos t$

$= t^3 D_x \cos t + \cos t \, D_x t^3$

$= t^3(-\sin t) + \cos t(3t^2)$

$= -t^3 \sin t + 3t^2 \cos t$

#3. $f(x) = \dfrac{x^2}{1+x}$

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

$= \dfrac{2x + 2x^2 - x^2}{(1+x)^2}$

$= \dfrac{2x + x^2}{(1+x)^2}$

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

$f''(1) = \dfrac{4}{16} = \dfrac{1}{4}$

Meghan Czarnecki

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

$y' = (2x+1)^5 \frac{d}{dx}(x^3-x+1)^4 + (x^3-x+1)^4 \frac{d}{dx}(2x+1)^5$

$y' = (2x+1)^5 \cdot 4(x^3-x+1)^3 \frac{d}{dx}(x^3-x+1) + (x^3-x+1)^4 \cdot 5(2x+1)^4 \frac{d}{dx}(2$

$y' = 4(2x+1)^5(x^3-x+1)^3(3x^2-1) + 5(x^3-x+1)^4(2x+1)^4 \cdot 2$

$y' = \left[2(2x+1)^4(x^3-x+1)^3\right](17x^3+6x^2-9x+3)$

(2) $xy + 2x + 3x^2 = 4$

$\frac{d}{dx}(xy + 2x + 3x^2) = \frac{d}{dx}(4)$

$\frac{d}{dx}(xy) + \frac{d}{dx}(2x) + \frac{d}{dx}(3x^2) = \frac{d}{dx}(4)$

$(1 \cdot y + x \cdot \frac{dy}{dx}) + (2) + (6x) = 0$

$y + x\frac{dy}{dx} + 2 + 6x = 0$

$-y \qquad\qquad -y$

$x\frac{dy}{dx} + 2 + 6x = -y$

$-2 \qquad\qquad -2$

$x\frac{dy}{dx} + 6x = -y - 2$

$-6x \qquad\qquad -6x$

$\frac{x\frac{dy}{dx}}{x} = \frac{-y-2-6x}{x}$

$\frac{dy}{dx} = \frac{-y-2-6x}{x}$ or $\frac{-(y+2+6x)}{x}$

Dylan Primrose

# 2.7

Answers

5. $y = x^3 + 2x$

given $\frac{dx}{dt} = 5$

when $x = 2$

$\frac{dy}{dt} = \frac{d}{dt}(x^3+2x)$

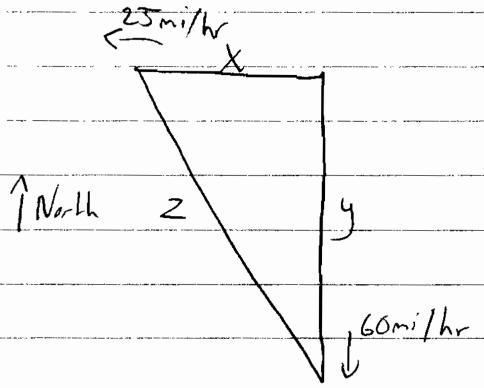
$\frac{dy}{dt} = (3x^2+2)\frac{dx}{dt}$

$\frac{dy}{dt} = (3(2)^2+2)(5)$

$\frac{dy}{dt} = (14)(5)$

$\frac{dy}{dt} = 70$

13.




we want to calculate $\frac{dz}{dt}$

$z^2 = x^2 + y^2$

$2z\frac{dz}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt}$ divide this side by $2z$

$\frac{dz}{dt} = \frac{1}{z}\left(x\frac{dx}{dt} + y\frac{dy}{dt}\right)$

$z = \sqrt{x^2+y^2}$

$z = \sqrt{50^2+120^2}$

$z = 130$

$\frac{dz}{dt} = \frac{1}{130}(50)(25)+126(60)$

$\frac{dz}{dt} = 65$ mi/hr

Nick Couchot

# $\boxed{2.8}$ Solutions

(12) $\sqrt{99.8}$

$y = \sqrt{x}$ $\quad y' = \frac{1}{2\sqrt{x}}$

$y - y_1 = m(x - x_1)$

or

$y = m(x - x_1) + y_1$

$y(100) = \sqrt{100}$

$\boxed{y(100) = 10}$

$y'(100) = \frac{1}{2\sqrt{100}}$

$\boxed{y'(100) = \frac{1}{20} = m}$

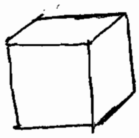
* NOW PLUG INTO EQUATION

$y = \frac{1}{20}(x - 100) + 10$

$= \frac{1}{20}(99.8 - 100) + 10$

$= \boxed{9.99}$

(21)



30cm

30cm edge with possible error of 0.1cm

a) Volume $= s^3$

$\frac{dV}{dt} = 3s^2 \frac{ds}{dt}$

$\frac{dV}{dt} = 3(30)^2(\pm 0.1)$

$\frac{dV}{dt} = \boxed{270 cm^3}$ MAX ERROR

relative error $= \frac{dV}{V}$

$\frac{3s^2}{s^3} \frac{ds}{dt} = \frac{3\, ds/dt}{s}$

$= \frac{(3)(0.1)}{30} = \boxed{0.1}$

% error $=$ relative error $\times 100$

$= (.01) \times 100$

$= \boxed{1\%}$

b) $SA = 6s^2$

$\frac{dSA}{dt} = 12s \frac{ds}{dt}$

$= 12(30)(\pm 0.1)$

$= \boxed{36 cm^2}$ [redacted]

[redacted]

$\frac{12s}{6s^2} \frac{ds}{dt} = \frac{2\frac{ds}{dt}}{s}$

$= \frac{2(0.1)}{30}$

$= \boxed{0.006}$

[redacted]

$.006 \times 100$

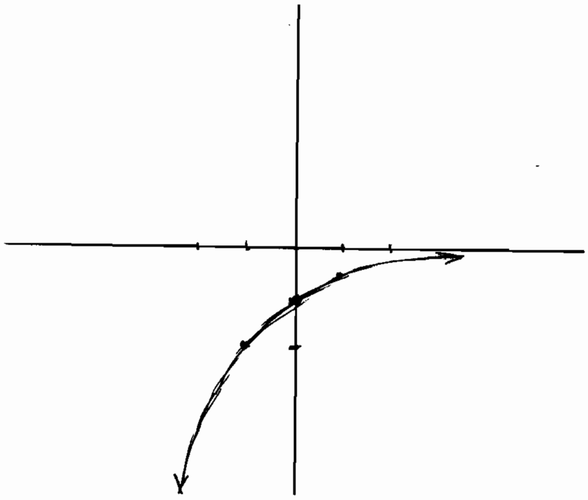
$= \boxed{.67\%}$

Nick Couchot

# 3.1 Solutions

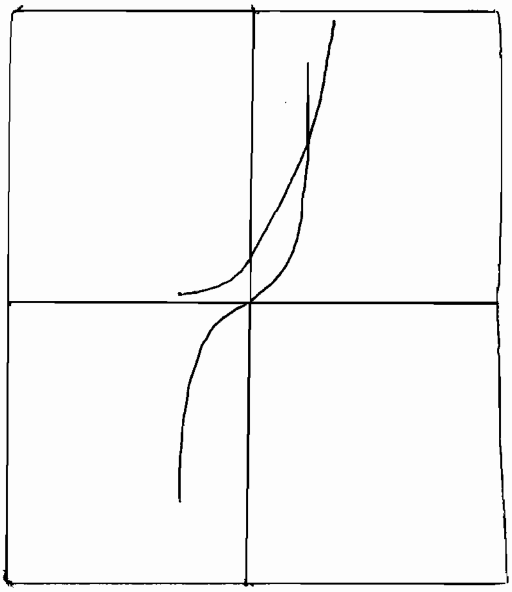
(9) $y = -2^{-x}$

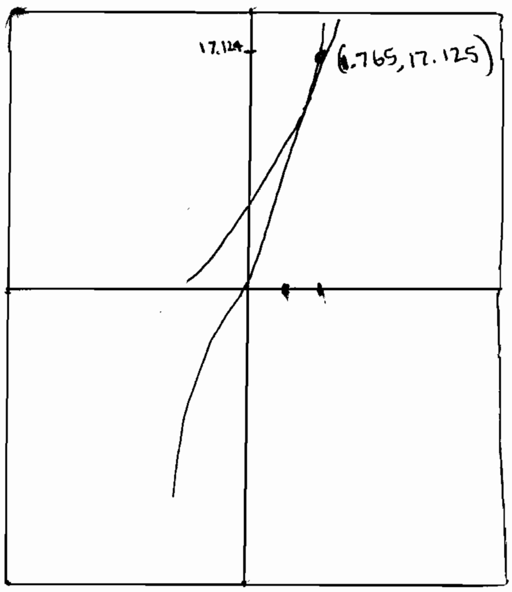
| x | y |
|---|---|
| 0 | -1 |
| 1 | -0.5 |
| -1 | -2 |



(20) $f(x) = x^5$ $g(x) = 5^x$

Point of Intersection
(1.765, 17.125)





Solutions: 3.2 - 3.3 MJ Marconi

21. $f(x) = \sqrt{10-3x}$

$y = \sqrt{10-3x}$

$x = \sqrt{10-3y}$

$x^2 = 10-3y$

$x^2-10 = 3y$

$y = \frac{x^2+10}{3}$

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

45. a) $\log_2 64$

$\log_2 2^6 = \boxed{6}$

b) $\log_6 \frac{1}{36}$

$\log_6 6^{-2} = \boxed{-2}$

Kerry Stanko

Answers

1.) $\lim\limits_{t \to 0} \dfrac{e^t - 1}{t^3}$ $\quad \dfrac{e^0 - 1}{0^3}$ $\quad \dfrac{1-1}{0} = \dfrac{0}{0}$

Use l'Hospital's Rule

$\dfrac{d_x (e^t - 1)}{d_x \; t^3} = \dfrac{e^t}{3t^2} = \dfrac{e^0}{3(0)^2} = \dfrac{1}{0}$ ← getting closer to 0,

so $\boxed{\infty}$

2.) $\lim\limits_{x \to 2} \dfrac{x^2 - 4}{\sin(x)}$ $\quad \dfrac{(2)^2 - 4}{\sin(2)} = \dfrac{4-4}{\sin(2)}$ $\quad \dfrac{0}{\sin(2)}$ $\boxed{0}$

cannot use l'Hospitals rule because not $\dfrac{\text{"0"}}{\text{"0"}}$ !

Joe · Answer Sheet 1

Section 4.3-4.4

4.3

11 $f(x) = x^3 - 12x + 1$

(a) intervals increasing/decreasing

$f'(x) = 3x^2 - 12$

$0 = 3(x^2 - 4)$

$= 3(x+2)(x-2)$

$x = -2, 2$

$+ \quad -2 \quad - \quad 2 \quad +$

increasing on $(-\infty, -2]$ & $[2, \infty)$

decreasing on $[-2, 2)$

(b) $f(-2) = (-2)^3 - 12(-2) + 1$

$-8 + 24 + 1 = -7 + 24 = 17 \rightarrow (-2, 17)$

$f(2) = (2)^3 - 12(2) + 1$

$8 - 24 + 1 = 9 - 24 = -15 \rightarrow (2, -15)$

max $= (-2, 17)$

min $= (2, -15)$

(c) $f'(x) = 3x^2 - 12$

$f''(x) = 6x$

$x = 0$

$(-\infty \ 0] =$ concave down

$[0, \infty) =$ concave up

Inflection point @ zero, one

$(0, 1)$

$- \quad 0 \quad +$

Joe · Answer Sheet 2

Section 4.4

11) $y = x^3 + x$

A = Domain: $\{x \mid \mathbb{R}\}$

B = Intercept: zero

C = Symmetry = about the x axis

D = Asymptotes = none

E = Intervals of Decrease or Increase =

$y = x^3 + x$
$y' = 3x^2 + 1$

$+ \quad + $

F max & min: none

G Concavity

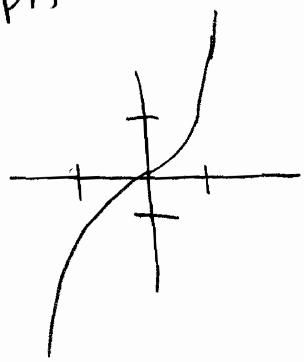
$y'' = 6x$

$- \quad 0 \quad +$

Joe · Answer Sheet 3

H Inflection Point: (0,0)

I Graph



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Problem # 57 → 4.4

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

Maggie Hartz
December 5, 2010

Final Review (4.1 - 4.2)

4.1

Find the absolute maximum and absolute minimum values of f on the given interval.

$f(x) = x^3 - 6x^2 + 9x + 2$ , $[-1, 4]$
$f'(x) = 3x^2 - 12x + 9$
$\dfrac{0 = 3x^2 - 12x + 9}{3}$

$0 = x^2 - 4x + 3$
$(x-1)(x-3) = 0$
$x - 1 = 0 \quad x - 3 = 0$
$x = 1, 3$

$f(-1) = -14$
$f(1) = 6$
$f(3) = 2$
$f(4) = 6$

abs max: $f(4) = 6$; $f(1) = 6$
abs min: $f(-1) = -14$

4.2

Verify that the function satisfies the hypotheses of the mean value theorem on the given interval. Then find all numbers c that satisfy the conclusion of the mean value theorem.

$f(x) = e^{-2x}$, $[0, 3]$
$f(0) = e^{-2(0)} = e^0 = 1$
$f(3) = e^{-2(3)} = e^{-6}$
$f'(x) = -2e^{2x}$
$(e^{-6} - 1) = -2e^{2x}(3)$
$\dfrac{(e^{-6} - 1)}{-6} = \dfrac{-6e^{2x}}{-6}$
$1/6(1 - e^{-6}) = e^{2x}$
$\ln(1/6(1 - e^{-6})) = \ln(e^{2x})$
$\dfrac{\ln(1/6(1 - e^{-6})) = 2x}{2}$

$1/2 \ln(1/6(1 - e^{-6})) = x$

Kathy
Poniche

① $f''(x) = 24x^2 + 2x + 10$

$f'(x) = (24)(\frac{1}{3})x^3 + (2)(\frac{1}{2})x^2 + 10x$

$= 8x^3 + x^2 + 10x + c$

$-3 = 8(1)^3 + (1)^2 + 10(1) + c$

$-3 = 8 + 1 + 10 + c$

$-3 = 19 + c$

$-22 = c$

$f'(x) = 8x^3 + x^2 + 10x - 22$

$f(x) = (8)(\frac{1}{4})x^4 + \frac{1}{3}x^3 + (10)(\frac{1}{2})x^2 - 22x$

$= 2x^4 + \frac{1}{3}x^3 + \frac{10}{2}x^2 - 22x + c$

$5 = 2(1)^4 + \frac{1}{3}(1)^3 + 5(1)^2 - 22(1) + c$

$5 = 2 + \frac{1}{3} + 5 - 22 + c$

$\frac{59}{3} = c$

$f(x) = 2x^4 + \frac{1}{3}x^3 + 5x^2 - 22x + \frac{59}{3}$

② $g(\theta) = \cos\theta - 5\sin\theta$

$\sin\theta + 5\cos\theta + c$

③ Lower estimate = 34.7 ft

upper estimate = 44.8 ft

FINAL REVIEW

## Section 5.2 Answers

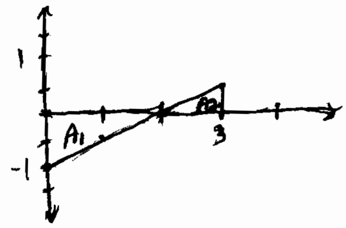
Chris Melvin

19) $\int_{-1}^{5} (1+3x)\,dx$

$\Delta x = \frac{b-a}{n} = \frac{(5)-(-1)}{n} = \frac{6}{n}$

$x_i = a + i\Delta x$
$x_i = -1 + \frac{6i}{n}$

$$\int_{-1}^{5} (1+3x)\,dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(x_i)\Delta x$$
$$= \lim_{n\to\infty} \sum_{i=1}^{n} \left[1 + 3\left(-1+\frac{6i}{n}\right)\right]\cdot\frac{6}{n}$$
$$= \lim_{n\to\infty} \sum_{i=1}^{n} \left[-2 + \frac{18i}{n}\right]\cdot\frac{6}{n}$$
$$= \lim_{n\to\infty} \frac{12}{n} \sum_{i=1}^{n} \left[\frac{9i}{n} - 1\right]$$
$$= \lim_{n\to\infty} \frac{12}{n}\left[\frac{9}{n}\sum_{i=1}^{n} i - \sum_{i=1}^{n} 1\right]$$
$$= \lim_{n\to\infty} \frac{12}{n}\left[\frac{9}{\cancel{n}}\cdot\frac{\cancel{n}(n+1)}{2} - n\right]$$
$$= \lim_{n\to\infty} \frac{12}{n}\left[\frac{9}{2}(n+1) - n\right]$$
$$= \lim_{n\to\infty} 54(n+1) - 12$$
$$= \lim_{n\to\infty} 54n + 54 - 12 = \lim_{n\to\infty} 54n + 42 = \boxed{42}$$

31) 


$$\int_0^3 \left(\tfrac{1}{2}x - 1\right)dx = A_1 + A_2$$
$$= \left(\tfrac{1}{2}b_1h_1\right) + \left(\tfrac{1}{2}b_2h_2\right)$$
$$= \left(\tfrac{1}{2}(2)(-1)\right) + \left(\tfrac{1}{2}(1)\left(\tfrac{1}{2}\right)\right)$$
$$= -1 + \frac{1}{4}$$
$$= \boxed{-3/4}$$

Made By Hector Martinez
solved Problems

From 5.3

#14. $\int_1^9 \frac{3x-2}{\sqrt{x}}dy = \frac{3x}{\sqrt{x}} - \frac{2}{\sqrt{x}} = \frac{3x}{x^{\frac{1}{2}}} - \frac{2}{x^{\frac{1}{2}}}$

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

$3\ \frac{x^{\frac{3}{2}}}{\frac{3}{2}} \quad 2\ \frac{x^{\frac{1}{2}}}{\frac{1}{2}} \quad (2(9)^{\frac{3}{2}} - 4(9)^{\frac{1}{2}}) - (2(1)^{\frac{3}{2}} - 4(1)^{\frac{1}{2}})$

$(2(27) - 4(3)\ ) - (2-4)$

$\frac{3}{1} \cdot \frac{2}{3} = 2 \quad 9^3 = 729 \quad (54 - 12) - (2-4)$

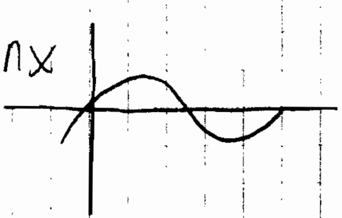
$(42) - (-2)$

$9^2 = 81 \quad \begin{array}{r} 27 \\ \times 27 \\ \hline 189 \\ 540 \\ \hline 729 \end{array} \quad \sqrt{729} = 27 \quad 42 + 2 = \boxed{44}$

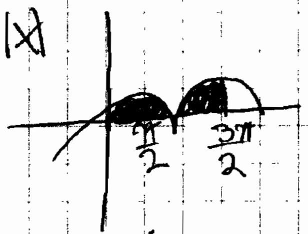
$\begin{array}{r} 81 \\ \times 9 \\ \hline 729 \end{array}$

#28. $\int_0^{3\pi/2} |\sin(x)|\,dx = |\cos(x)|$

sinx



sin|x|




$|\sin 3\pi/2)| - |\sin(0)|$
$|-1| \quad |\pi|$
$1 - 0 = 1 + \frac{1}{2} = \boxed{\frac{3}{2}}$