Test #2 Review Exercise Answers

1.
   a) $\frac{5x^4y^2+3y-2xy^2\sin y}{x^2y^2\cos y+3x}$
   b) $\frac{4xe^y\sqrt{y}}{1-2x^2e^y\sqrt{y}}$
   c) $\frac{(y^2+3)\csc^2(x+y)}{2y-(y^2+3)\csc^2(x+y)}$

2.
   a) $y-1=-\frac{4}{5}(x-2)$ (or $y=-\frac{4}{5}x+\frac{13}{5}$)
   b) $y-1=(-\pi-3)(x+1)$ (or $y=(-\pi-3)x-\pi-2$)

3.
   a) $\frac{e^{-5x^2+1}\cdot\sqrt[3]{x^2-4}\cdot\sin x}{x\cdot(x^3+1)^5\cdot\sqrt{x+5}}\cdot\left(-10x+\frac{2x}{3(x^2-4)}+\cot x-\frac{1}{x}-\frac{15x^2}{x^3+1}-\frac{1}{2(x+5)}\right)$
   b) $x^{\sec x}\left(\frac{\sec x}{x}+\ln x\sec x\tan x\right)$
   c) $(\csc x)^{1/x}\left(-\frac{\cot x}{x}-\frac{\ln(\csc x)}{x^2}\right)$

4.
   a) -9 m/s
   b) $t=2$ sec
   c) $t>2$ sec
   d) (diagram coming soon!)
   e) 23 m
   f) $a(t)=6t,\ \ a(5)=30$ m/s^2
   g) Speeding up: $t>2$ sec, Slowing down: 0 sec $<t<2$ sec

5. 36π in^3/in

6. $\frac{3}{7}$ g/mm

7.
   a) The area is increasing by 68 cm^2/s.
   b) The perimeter is increasing by 8 cm/s.

8. The top is sliding down the wall at a rate of 1.5 ft/s.

9. 198.46 mi/h

10. $\frac{9}{250}$ cm/min (or 0.036 cm/min)

11. See Homework #10 Solutions.

12. See Homework #10 Solutions.

13. See Homework #10 Solutions.

14. $dy=(-e^{-x}\sin x-e^{-x}\cos x)dx$

15. $dy = \left(\frac{3}{|3x|\sqrt{9x^2-1}}\right)dx$

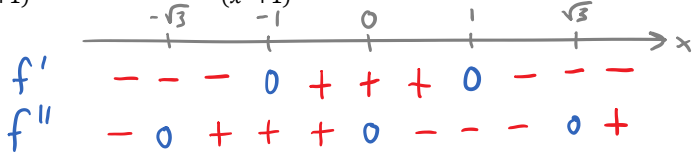
16. 0.00412

17.
   a) Estimated maximum error: π ft^2, Relative error: 0.04, Percentage error: 4%
   b) Estimated maximum error: 0.2π ft, Relative error: 0.02, Percentage error: 2%

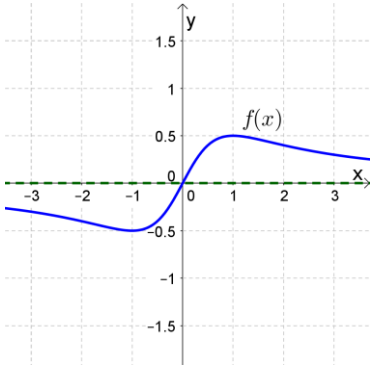
18. 0.724492

19.
   a) 0
   b) $\frac{2}{9}$
   c) 1
   d) 0
   e) $\frac{1}{2}$
   f) 1
   g) 1

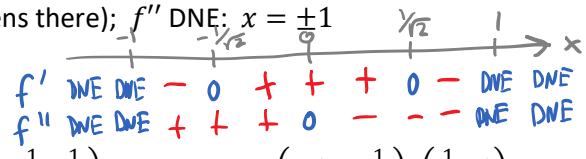
20.
   a) $(-\infty, \infty)$
   b) x-intercept: $(0,0)$; y-intercept: $(0,0)$
   c) VA: none, HA: $y = 0$
   d) $f'(x) = \frac{1-x^2}{(x^2+1)^2}$ and $f''(x) = \frac{2x(x^2-3)}{(x^2+1)^3}$; $f' = 0$: $x = \pm 1$; $f'' = 0$: $x = 0, \pm\sqrt{3}$
   e)



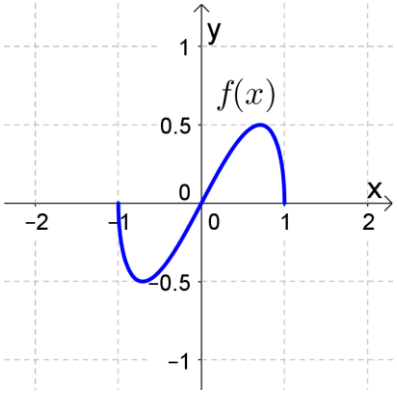
   f) Increasing: $(-1, 1)$; Decreasing: $(-\infty, -1), (1, \infty)$
   g) Concave up: $\left(-\sqrt{3}, 0\right), \left(\sqrt{3}, \infty\right)$; Concave down: $\left(-\infty, -\sqrt{3}\right), \left(0, \sqrt{3}\right)$
   h) Local max: $\left(1, \frac{1}{2}\right)$; Local min: $\left(-1, -\frac{1}{2}\right)$; Inflection points: $\left(-\sqrt{3}, -\frac{\sqrt{3}}{4}\right)$, $(0,0)$, $\left(\sqrt{3}, \frac{\sqrt{3}}{4}\right)$
   i) See graph to right.



21.
   a) $[-1, 1]$
   b) x-intercepts: $(0,0), (\pm 1, 0)$; y-intercept: $(0,0)$
   c) VA: none, HA: none
   d) $f'(x) = \frac{1-2x^2}{\sqrt{1-x^2}}$ and $f''(x) = \frac{x(2x^2-3)}{(1-x^2)^{3/2}}$; $f' = 0$: $x = \pm\frac{1}{\sqrt{2}}$; f' DNE: $x = \pm 1$; $f'' = 0$: $x = 0, \pm\sqrt{\frac{3}{2}}$ (note that $\pm\sqrt{\frac{3}{2}}$ are not in domain, so nothing happens there); f'' DNE: $x = \pm 1$
   e)



   f) Increasing: $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$; Decreasing: $\left(-1, -\frac{1}{\sqrt{2}}\right), \left(\frac{1}{\sqrt{2}}, 1\right)$
   g) Concave up: $(-1, 0)$; Concave down: $(0, 1)$



h) Local max: $\left(\frac{1}{\sqrt{2}}, \frac{1}{2}\right)$; Local min: $\left(-\frac{1}{\sqrt{2}}, -\frac{1}{2}\right)$; Inflection point: $(0, 0)$

i) See graph to right.

22.

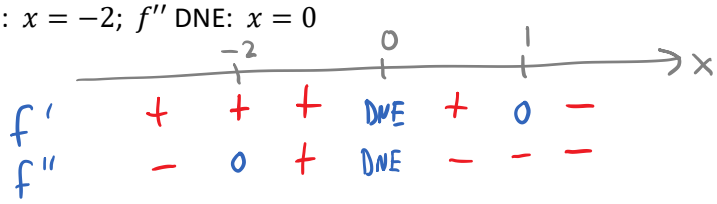
a) $(-\infty, \infty)$

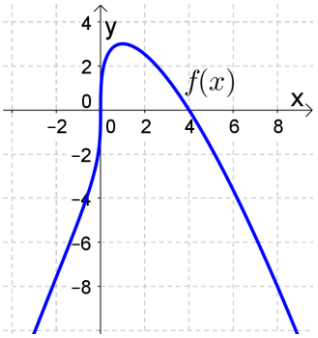
b) x-intercepts: $(0, 0)$, $(4, 0)$; y-intercept: $(0, 0)$

c) VA: none, HA: none

d) $f'(x) = -\frac{4(x-1)}{3x^{2/3}}$ and $f''(x) = -\frac{4(x+2)}{9x^{5/3}}$; $f' = 0$: $x = 1$; f' DNE: $x = 0$; $f'' = 0$: $x = -2$; f'' DNE: $x = 0$

e)





f) Increasing: $(-\infty, 1)$; Decreasing: $(1, \infty)$

g) Concave up: $(-2, 0)$; Concave down: $(-\infty, -2)$, $(0, \infty)$

h) Local max: $(1, 3)$; Inflection points: $\left(-2, 6\sqrt[3]{-2}\right)$, $(0, 0)$

i) See graph to right.

23.

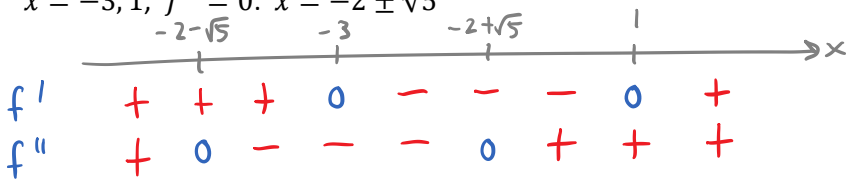
a) $(-\infty, \infty)$

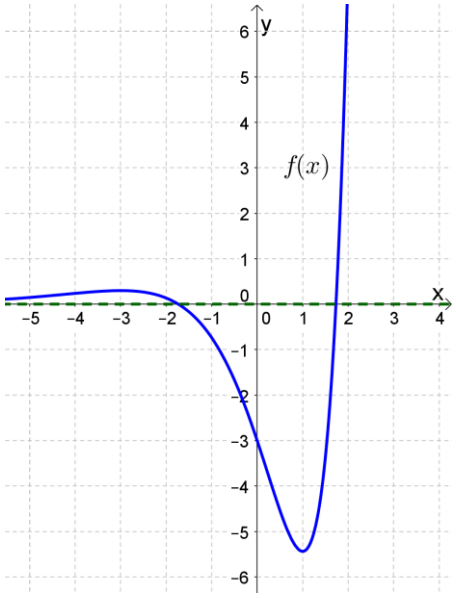
b) x-intercept: $\left(\pm\sqrt{3}, 0\right)$; y-intercept: $(0, -3)$

c) VA: none, HA: $y = 0$

d) $f'(x) = e^x(x^2 + 2x - 3)$ and $f''(x) = e^x(x^2 + 4x - 1)$; $f' = 0$: $x = -3, 1$; $f'' = 0$: $x = -2 \pm \sqrt{5}$

e)





f) Increasing: $(-\infty, -3)$, $(1, \infty)$; Decreasing: $(-3, 1)$

g) Concave up: $\left(-\infty, -2 - \sqrt{5}\right)$, $\left(-2 + \sqrt{5}, \infty\right)$; Concave down: $\left(-2 - \sqrt{5}, -2 + \sqrt{5}\right)$

h) Local max: $\left(-3, \frac{6}{e^3}\right)$; Local min: $(1, -2e)$; Inflection points: $\left(-2 - \sqrt{5}, 0.216\right)$, $\left(-2 + \sqrt{5}, -3.728\right)$

i) See graph to right.