

Math 180 - 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) $t = 2 \text{ sec}$

c) $t > 2 \text{ sec}$

d) (diagram coming soon!)

e) 23 m

f) $a(t) = 6t, a(5) = 30 \text{ m/s}^2$

g) Speeding up: $t > 2 \text{ sec}$, Slowing down: $0 \text{ sec} < t < 2 \text{ sec}$

5. $36\pi \text{ in}^3/\text{in}$

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

7.

a) The area is increasing by $68 \text{ cm}^2/\text{s}$.

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. $\frac{9}{250} \text{ cm/min}$ (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: $\pi \text{ ft}^2$, Relative error: 0.04, Percentage error: 4%
- b) Estimated maximum error: $0.2\pi \text{ ft}$, Relative error: 0.02, Percentage error: 2%

18. 0.724492

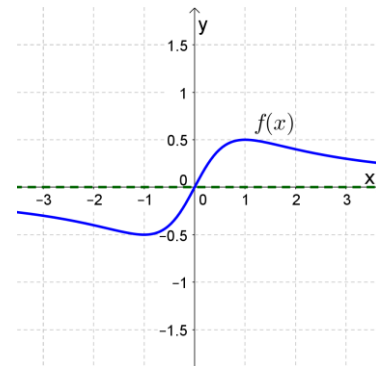
19.

- 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)

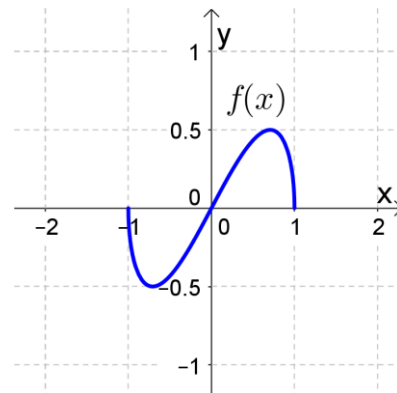
	- $\sqrt{3}$	-1	0	1	$\sqrt{3}$	
f'	-	-	0	+	+	-
f''	-	0	+	+	0	+
- f) Increasing: $(-1, 1)$; Decreasing: $(-\infty, -1), (1, \infty)$
- g) Concave up: $(-\sqrt{3}, 0), (\sqrt{3}, \infty)$; Concave down: $(-\infty, -\sqrt{3}), (0, \sqrt{3})$
- h) Local max: $(1, \frac{1}{2})$; Local min: $(-1, -\frac{1}{2})$; Inflection points: $(-\sqrt{3}, -\frac{\sqrt{3}}{4}), (0, 0), (\sqrt{3}, \frac{\sqrt{3}}{4})$
- 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)

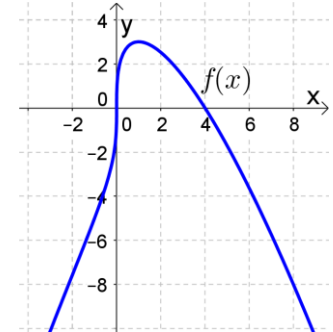
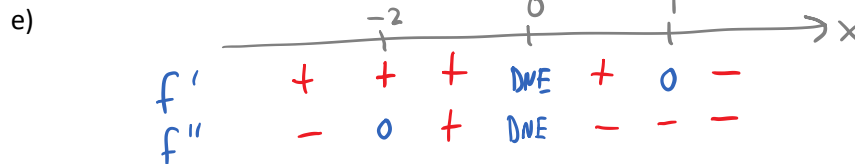
	-1	- $\frac{1}{\sqrt{2}}$	0	$\frac{1}{\sqrt{2}}$	1	
f'	DNE	DNE	-	0	+	+
f''	DNE	DNE	+	+	+	0
- f) Increasing: $(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$; Decreasing: $(-1, -\frac{1}{\sqrt{2}}), (\frac{1}{\sqrt{2}}, 1)$
- g) Concave up: $(-1, 0)$; Concave down: $(0, 1)$



- h) Local max: $(\frac{1}{\sqrt{2}}, \frac{1}{2})$; Local min: $(-\frac{1}{\sqrt{2}}, -\frac{1}{2})$; Inflection point: $(0, 0)$
 i) See graph to right.

22.

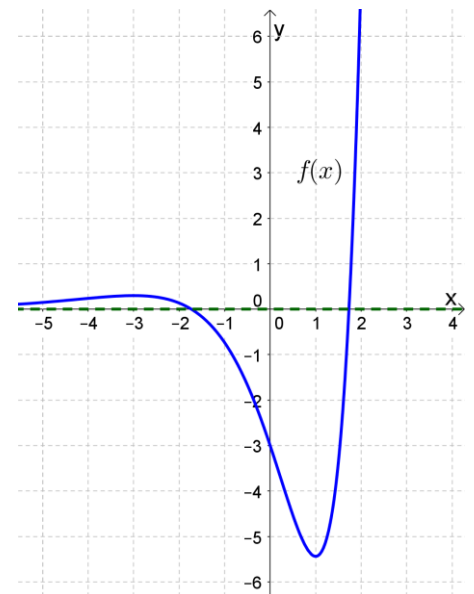
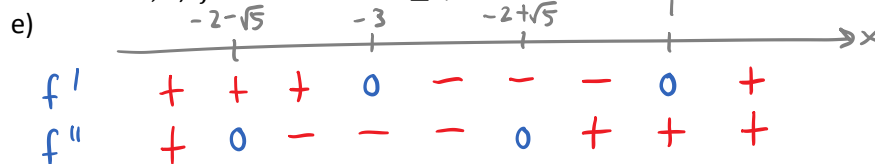
- a) $(-\infty, \infty)$
 b) x-intercepts: $(0, 0), (4, 0)$; y-intercept: $(0, 0)$
 c) VA: none, HA: none
 d) $f'(x) = -\frac{4(x-1)}{3x^{2/3}}$ and $f''(x) = -\frac{4(x+2)}{9x^{5/3}}$; $f' = 0: x = 1$; f' DNE: $x = 0$;
 $f'' = 0: x = -2$; f'' DNE: $x = 0$



- 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: $(-2, 6\sqrt[3]{-2}), (0, 0)$
 i) See graph to right.

23.

- a) $(-\infty, \infty)$
 b) x-intercept: $(\pm\sqrt{3}, 0)$; y-intercept: $(0, -3)$
 c) VA: none, HA: $y = 0$
 d) $f'(x) = e^x(x^2 + 2x - 3)$ and $f''(x) = e^x(x^2 + 4x - 1)$; $f' = 0$:
 $x = -3, 1$; $f'' = 0: x = -2 \pm \sqrt{5}$



- f) Increasing: $(-\infty, -3), (1, \infty)$; Decreasing: $(-3, 1)$
 g) Concave up: $(-\infty, -2 - \sqrt{5}), (-2 + \sqrt{5}, \infty)$; Concave down:
 $(-2 - \sqrt{5}, -2 + \sqrt{5})$
 h) Local max: $(-3, \frac{6}{e^3})$; Local min: $(1, -2e)$; Inflection points:
 $(-2 - \sqrt{5}, 0.216), (-2 + \sqrt{5}, -3.728)$
 i) See graph to right.