MATH 1041 **Review Problems for Test 2** **Fall 2023**

1. Text: James Stewart, _Calculus, Early Transcendentals_, **8th** Edition, Cengage Learning
2. _Supplementary Exercises_ (**SE**)

Chapter 3: Differentiation Rules

3.3: Problem 2: $f'(x) = -x\sin(x) + \cos(x) + 2\sec^2(x)$ Problem 8: $f'(t) = \dfrac{-\csc^2(t) - \cot(t)}{e^t}$

3.4: Problem 14: $f'(t) = \pi t\cos(\pi t) + \sin(\pi t)$ Problem 62: $h'(1) = \dfrac{6}{5}$

3.5: Problem 20: $\dfrac{dy}{dx} = \dfrac{(x^2+1)^2\sec^2(x-y) + 2xy}{(x^2+1) + (x^2+1)^2\sec^2(x-y)}$ Problem 50: $y' = \dfrac{2x}{x^4+1}$

Problem 60: $y' = \dfrac{-1}{2+2x}\sqrt{\dfrac{1+x}{1-x}}$

3.6: Problem 4: $f'(x) = 2\cot(x)$

Problem 40: $y' = \left(-1 - 2\tan(x) - \dfrac{2x+1}{x^2+x+1}\right)\dfrac{e^{-x}\cos^2(x)}{x^2+x+1}$

3.7: Problem 2:

- Part (a): $v(t) = \dfrac{81 - 9t^2}{(t^2+9)^2}$
- Part (b): $v(1) = \dfrac{18}{25}$ ft/sec
- Part (c): It's at rest at time $t = 3$ sec
- Part (d): It movese in the positive direction for $t\ in[0,3)$
- Part (e): Total distance traveled on $[0,6]$ is $\dfrac{9}{5}$ ft
- Part (g): $a(t) = \dfrac{18t^3 - 486t}{(t^2+9)^3}$ and $a(1) = \frac{-117}{250}$ feet per square second
- After one second, it's slowing down.

Problem 4:

- Part (a): $v(t) = (2t - t^2)e^{-t}$
- Part (b): $v(1) = \dfrac{1}{e}$ ft/sec

- Part (c): It's at rest at time $t = 0$ sec and at time $t = 2$ sec
- Part (d): It movese in the positive direction for $t \ in(0, 2)$
- Part (e): Total distance traveled on $[0, 6]$ is $\dfrac{8e^4 - 36}{e^6}$ ft
- Part (g): $a(t) = (t^2 - 4t + 2)e^{-t}$ and $a(1) = \frac{-1}{e}$ feet per square second
- After one second, it's slowing down.

3.9: Problem 4: 140 cm per square second

Problem 10:

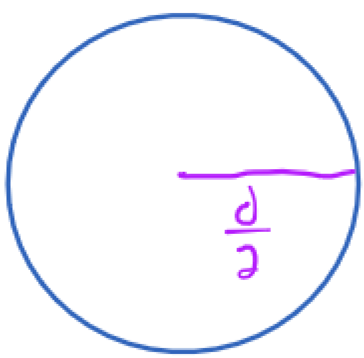
(a) $-\dfrac{\sqrt{5}}{4}$

(b) $\dfrac{4}{\sqrt{5}}$

Problem 14:

(a) We know the snowball's surface area decreases at a rate of 1 cm^2/sec

(b) We want to know the rate at which the snowball's diameter decreases when this diameter is 10 cm



(c)

(d) In terms of the radius r, surface area would be $A = 4\pi r^2$. We want to work with diameter d, and we know $r = d/2$ This gives us $A = \pi d^2$.

(e) The diameter decreases at $\frac{1}{20\pi}$ cm/sec.

Problem 30: The angle decreases at a rate of $\dfrac{1}{50}$-th of a radian per second.

3.10: (No even-numbered problems assigned)

Chapter 4: Applications of Differentiation

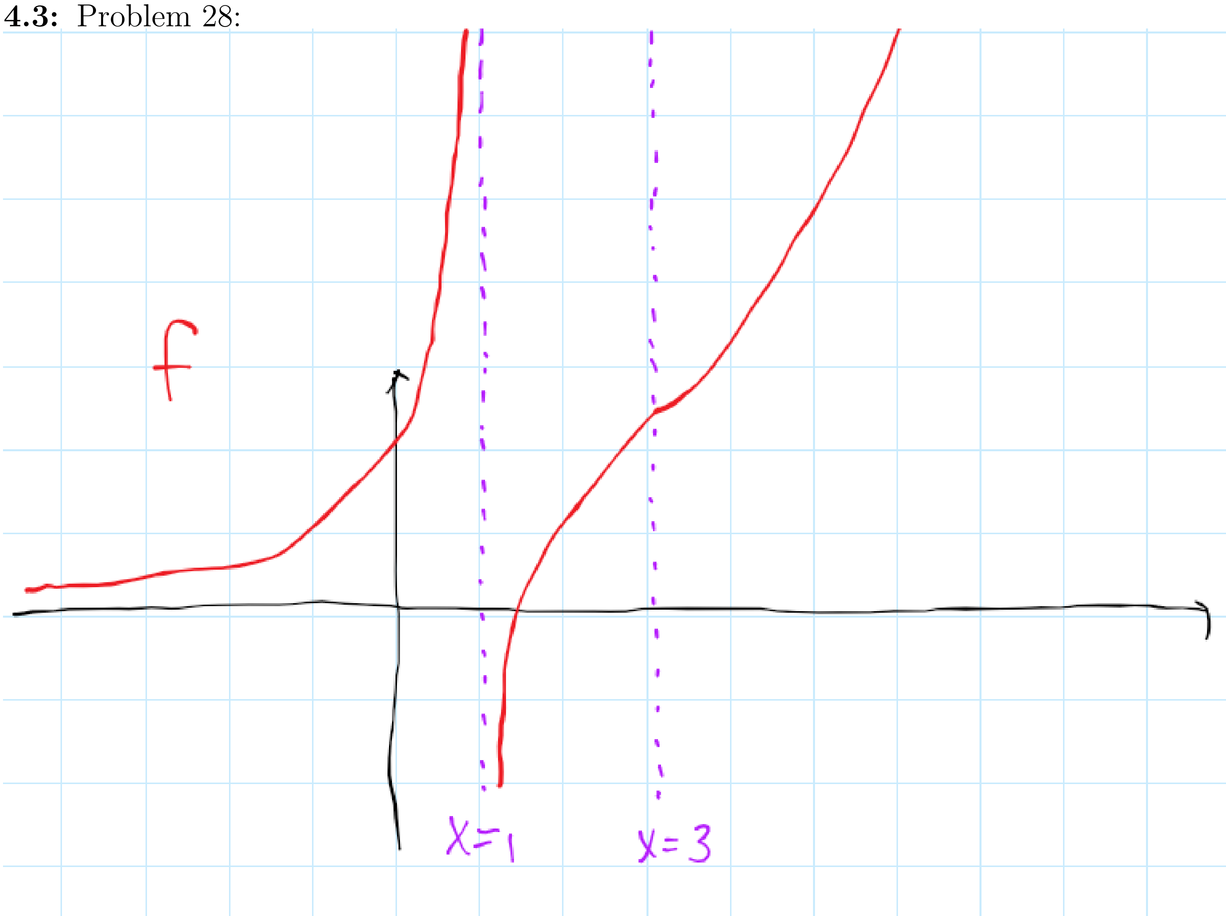
4.1: Problem 52: Absolute Maximum if $f(3) = 125$, absolute minimum is $f(0) = -64$

Problem 60: Absolute Maximum if $f(1) = \sqrt{e}$, absolute minimum is $f(-2) = \dfrac{-2}{e}$

4.2: Problem 12: f is a polynomial, so it is everywhere differentiable. In particular, it is continuous on $[-2, 2]$ and differentiable on $(-2, 2)$. The conclusion of the Mean Value Theorem is satisfied for $c = \dfrac{2}{\sqrt{3}}$ and $c = \dfrac{-2}{\sqrt{3}}$.

Problem 14: f is a rational function, so it is differentiable at any point where its denominator isn't zero. So f is indeed continuous on $[1, 3]$ and differentiable on $(1, 3)$. The conclusion of the Mean Value Theorem is satisfied for $c = \sqrt{3}$.

4.3: Problem 28:



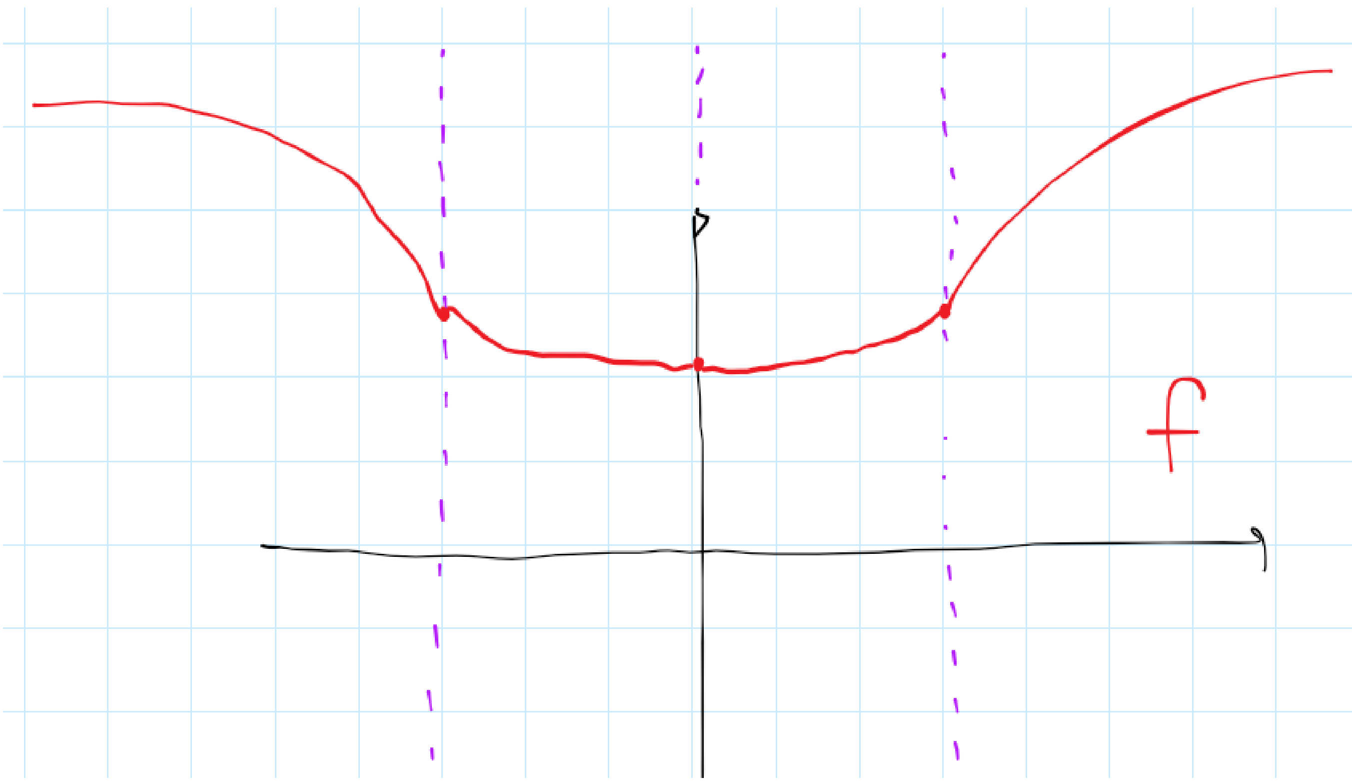
Problem 46:

(a) Increasing in $(0, \infty)$, decreasing on $(-\infty, 0)$

(b) $f(0) = \ln(9)$ is the only local minimum, there are no local maxima

(c) CU on $(-3, 3)$, CD on $(-\infty, -3) \cup (3, \infty)$, the inflection points are $(-3, \ln(18))$ and $(3, \ln(18))$

(d)



4.4:

Problem 14: $\frac{3}{2}$

Problem 16: 2

Problem 20: $\frac{-1}{2}$

Problem 32: 0

Problem 40: 2