

MA161 Final Exam Guide

1. Limits

$$(a) \lim_{x \rightarrow 3} \left[\frac{1}{(x-3)} - \frac{1}{(x^2 - 5x + 6)} \right] =$$

$$(b) \lim_{x \rightarrow +\infty} \left[\sqrt{x^2 + 8x} - x \right] =$$

$$(c) \lim_{x \rightarrow -4^+} \frac{1}{x+4} =$$

$$(d) \lim_{x \rightarrow -4} \frac{1}{x+4} =$$

$$(e) \lim_{x \rightarrow -4} \frac{-7}{(x+4)^2} =$$

$$(f) \lim_{x \rightarrow +\infty} e^x \sin x =$$

$$(g) \lim_{x \rightarrow +\infty} \frac{\sin x}{x} =$$

$$(h) \lim_{x \rightarrow 0} \frac{\sin x}{x} =$$

$$(i) \lim_{x \rightarrow \pi/2} \frac{\sin x}{x} =$$

$$(j) \lim_{x \rightarrow 1} \frac{x^7 - 1}{x^5 - 1} =$$

$$(k) \lim_{x \rightarrow 0} \left(1 + \frac{1}{2}x\right)^{1/x} =$$

$$(l) \lim_{x \rightarrow 2} 7 =$$

$$(m) \lim_{x \rightarrow 2} x^3 + 3 =$$

$$(n) \lim_{x \rightarrow -4^-} \frac{1}{x + 4} =$$

2. Use the limit definition of the derivative to find $f'(x)$.

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

3. Find $f'(x)$

(a) $f(x) = 2$

(b) $f(x) = x$

(c) $f(x) = e^{2x} - 3x$

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

(e) $f(x) = \tan^{-1} x$

(f) $f(x) = \sqrt{x^4 + 5}$

(g) $f(x) = \sin^3 x$

(h) $f(x) = x^3 e^{2x+5}$

(i) $f(x) = x^x$

4. Find the absolute maximum and absolute minimum values of $f(x) = x^3 - 3x + 1$ on the interval $[0,3]$.

5. Find an equation of the tangent line to the graph of $y = x^5$ at $x = 2$. Then use it to approximate $(2.04)^5$.

6. (a) Find the point on the line $y = x + 1$ that is closest to the point $(1,1)$. Hint, use the distance formula between $(1,1)$ and $(x,x+1)$.
- (b) If 1200 square centimeters of material is available to make an open box with a square base, find the largest possible volume for the box.
7. (a) If the radius of a circle is increasing at a rate of 1.5 cm/s , find the rate at which the area is changing when the radius is 4 cm .
- (b) Ship A is 150 miles west of Ship B. Ship A sails south at a rate of 30 miles per hour. Ship B sails north at a rate of 40 miles an hour. Find the rate at which the distance between the ships is changing two hours later.

8. Evaluate the indefinite integral.

$$(a) \int \sin^2(x) \cos(x) dx =$$

$$(b) \int e^{3x-2} dx =$$

$$(c) \int \frac{2x}{x^2+1} dx =$$

$$(d) \int \frac{7+2x}{x^2+1} dx =$$

$$(e) \int 4x^3(x^4+1)^5 dx =$$

$$(f) \int \frac{2x^3}{\sqrt{x^4+5}} dx =$$

9. Find the area of the region that lies under the graph of

$$f(x) = \sqrt[4]{x}$$

between $x = 1$ and $x = 16$.

10. Given the following information, find $f(x)$.

(a) $f''(x) = 6x - 4$

(b) $f'(-1) = 13$

(c) $f(2) = 20$

11. Find the volume of the solid obtained by revolving the region between the x -axis and the curve

$$y = \sqrt[3]{x}$$

over $0 \leq x \leq 8$, around the x -axis.