

NAME:

STUDENT ID:

INSTRUCTOR:

TA:

Grading Table

Question	Possible Points	Points Earned
1	15	
2	10	
3	10	
4	10	
5	10	
6	15	
7	10	
8	10	
9	10	
EC	10	
Total	100	

Please read these instructions carefully before beginning.

1. Do not open the exam until 2:45. You will have 2 hours to complete the exam.
2. If θ is an angle which is not one of our “special angles”, then an answer involving $\sin(\theta)$ or $\cos(\theta)$ is considered simplified.
3. Final answers must be written clearly in the proper space provided. No credit will be given for illegible or ambiguous answers. Answers with no justification will not be given credit.
4. No notes, calculators, or electronic devices are permitted.
5. *Have a great break!*

1. (15 points) Compute the following limits:

(a)

$$\lim_{x \rightarrow 0} \frac{\tan(2x)}{x \cos(3x)}$$

(b) Use the sandwich (squeeze) theorem to determine

$$\lim_{x \rightarrow 0} x^2 \cos\left(\frac{1}{x^3}\right)$$

(c)

$$\lim_{x \rightarrow \sqrt{3}} \frac{\sqrt{3} - x}{3 - x^2}$$

2. (10 points)

- (a) Find all points where the tangent line to $f(x) = x^3 - 2x + 1$ is parallel to the line $y = 10x - 8$.
Write the equations for each of these tangent lines.

- (b) Find the equation for a parabola with vertex $(1, 3)$ which goes through the point $(3, 5)$.

3. (10 points) Let $f(x) = \frac{x}{x-1}$.

Using the definition of derivative, find $f'(x)$.

4. (10 points) Find the tangent line to the following curve at the point $(0, 1)$.

$$\cos(\sin(xy)) = y \cos(x)$$

5. (10 points) Compute the following derivatives. *Do not simplify.*

(a)

$$\frac{d}{dx} \left(\frac{x^2 - 1}{\cos(x) \sin(x) + 2} \right)$$

(b)

$$\frac{d}{dx} (\cos(\sin(x^2 - 7)))$$

6. (15 points) Let $f(x) = \frac{(3x - 1)(x + 1)}{(x - 1)(x + 2)}$

(a) Find all horizontal and vertical asymptotes of $f(x)$.

(b) For each vertical asymptote $x = a$, find $\lim_{x \rightarrow a^+} f(x)$ and $\lim_{x \rightarrow a^-} f(x)$.

(c) Use your work above to sketch $f(x)$.

7. (10 points) You are flying a kite. Assume that the string is a straight line.

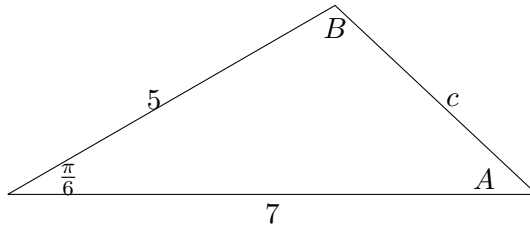
(a) If the angle of the string to level ground is $\frac{\pi}{3}$ radians and the kite string has been let out 300 feet, how high is the kite?

(b) If the length of the string and the angle of the string to level ground are as above and the angle is changing at -0.2 radians per minute, what is the rate of change of the kite's height?

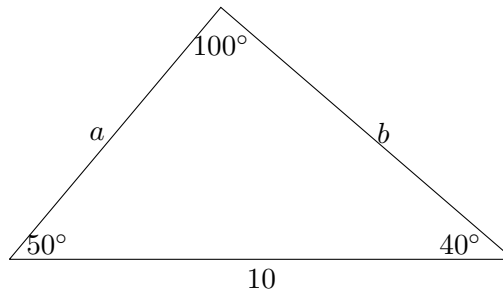
8. (10 points) Find the tangent line to the function $f(x) = \sin(x)$ at the point $x = \frac{\pi}{3}$. Use this to approximate $\sin(\frac{\pi}{3} + .002)$.

9. (10 points)

(a) Find the side-length c as well as the values of $\cos(A)$ and $\cos(B)$.



(b) Express the side-lengths a and b in terms of the given information.



Extra Credit (10 points)

Suppose θ is an angle so that $\sin(\theta) = \frac{3}{5}$ and $\frac{\pi}{2} \leq \theta \leq 3\frac{\pi}{2}$.

(a) Find $\cos(\theta)$.

(b) Find $\sin(2\theta)$.

(c) Find $\cos(\frac{\theta}{2} - \pi)$.

(d) Find $\csc(\theta + \frac{5\pi}{2})$.