

Math 161 - 2022 Spring - Common Final Exam

Name: _____

Section Number: _____ Instructor Name: _____

Question	Points	Score
1	20	
2	8	
3	10	
4	10	
5	15	
6	10	
7	10	
8	15	
9	15	
10	10	
11	15	
12	12	
Total:	150	

- This exam has 12 questions worth a total of 150 points. Please check that your exam is complete, but otherwise do not look at the exam until the official start.
- Fill in your name and section above.
- Show your work. Correct work without corresponding work may not receive credit.
- You have 120 minutes to complete this exam.
- Technology of any kind is prohibited. The use of any notes is prohibited.

1. (20 points) Compute $\frac{d}{dx}[y]$ for:

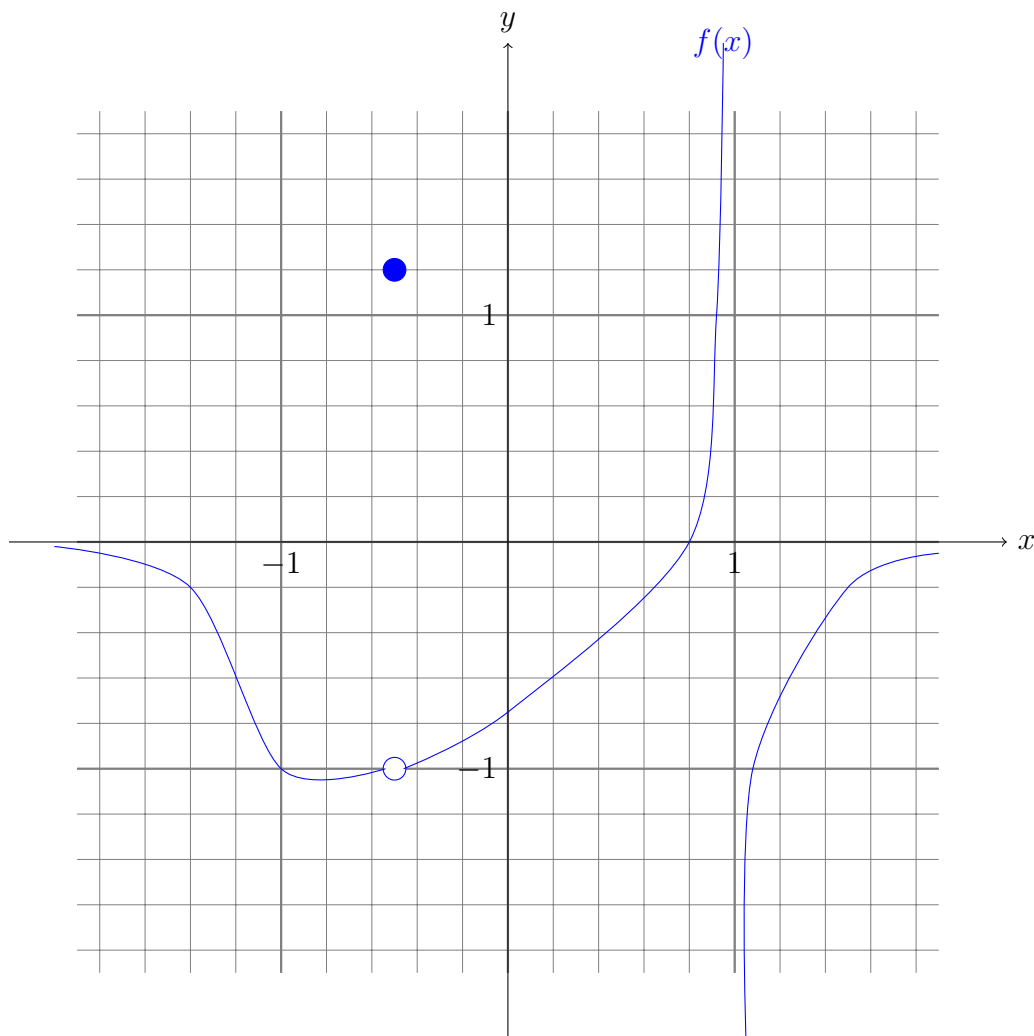
(a) $y = (\tan x)e^{11x}$

(b) $y = (x^7 - 1)^3$

(c) $y = \cos(\sin(\pi x))$

(d) $y = \frac{11x + 13 - \frac{17}{x}}{x^{2/3}}$. Then compute $\frac{d}{dx} \left[\frac{dy}{dx} \right]$

2. (8 points) The graph of the function $f(x)$ is shown below:



Based on the graph of f , answer the following:

(a) $\lim_{x \rightarrow -0.5} f(x) =$

(b) $\lim_{x \rightarrow 1^+} f(x) =$

(c) $\lim_{x \rightarrow \pm\infty} f(x) =$

(d) $f(-0.5) =$

3. (10 points) Consider

$$y = 3x^5 - 20x^3 - 75x + 999.$$

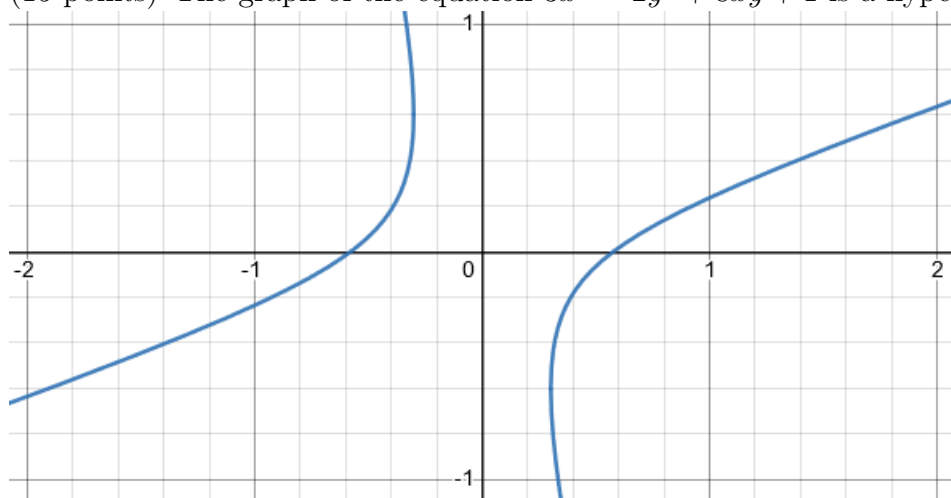
Find all critical points and all inflection points. You do **not** have to classify the critical points, but you **do** have to distinguish between potential inflection points and actual inflection points.

4. (10 points) Consider

$$y = \frac{x^2 + 6x + 9}{2x^2 - 18}.$$

Find all horizontal and vertical asymptotes. Classify any other discontinuities that exist.

5. (15 points) The graph of the equation $3x^2 = 2y^2 + 8xy + 1$ is a hyperbola as shown below:



- (a) The hyperbola intersects the x-axis twice. Find the x values of those two points. (Eyeing this is not good, as they are not rational numbers.)

- (b) Implicit differentiation yields $6x = 4yy' + 8(y + xy')$. Solve for y' .

- (c) Find the x values at which the tangent line is vertical.

6. (10 points) Find the point on the line $y = 3x - 2$ which is closest to the origin.
7. (10 points) A streetlight is mounted at the top of a 15 foot pole. A 6 foot tall person walks away from the streetlight at 2 feet per second. How fast is the length of the person's shadow growing when the person is 23 feet from the pole?

8. (15 points) Consider the function

$$y = f(x) = e^{3x}.$$

(a) Find the equation of the line $L(x)$ which is tangent to $f(x)$ when $x = 2$.

(b) Find the third-order Taylor polynomial centered at $c = 2$ for $f(x)$.

9. (15 points) Evaluate the following limits

(a) $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 - 5x + 6}$

(b) $\lim_{x \rightarrow 1^+} \frac{e^x - e}{\ln x}$

10. (10 points) Evaluate the following indefinite integrals:

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

(b) $\int \frac{3x}{\sqrt{2+x^2}} dx$

11. (15 points) Evaluate the following definite integrals:

(a) $\int_0^5 \sqrt{25 - x^2} \, dx$

(b) $\int_{\pi/6}^{\pi/2} 1 + \sin(x) \, dx$

12. (12 points) Multiple choice

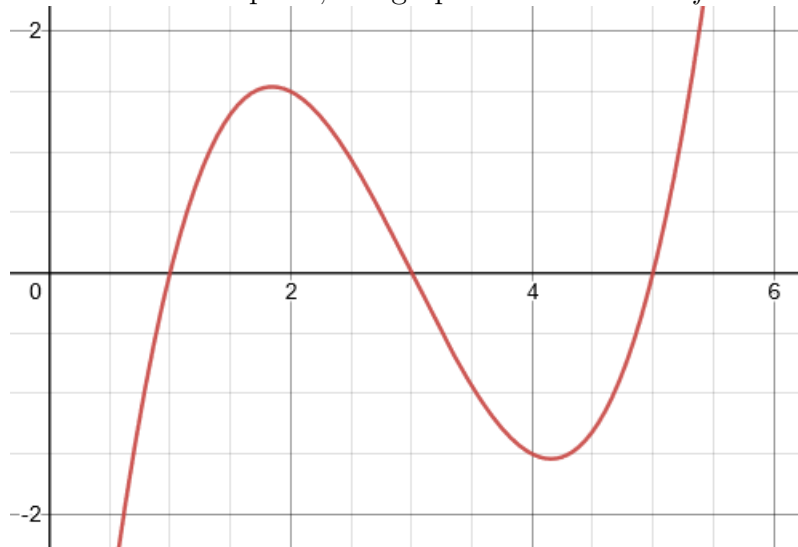
(a) Which function is an antiderivative of $f(x) = \ln(x)$?

- (I) $\frac{1}{x}$ (II) $x \ln x - x$ (III) $x \ln x + x$ (IV) $\frac{(\ln x)^2}{2}$

(b) $\int_7^7 (e^{x^2} \cos(x))(x^5 - x^x) dx =$

- (I) 0 (II) $(e^{t^2} \cos(t))(t^5 - t^t)$ (III) $(e^{t^2} \cos(t))(t^5 - t^t) + C$

For the next two parts, the graph of the function f is shown below:



(c) Using the graph above, which is the largest quantity?

- (I) $\int_1^3 f(x) dx$ (II) $\int_3^5 f(x) dx$ (III) $\int_1^5 f(x) dx$

(d) Using the graph above, from $x = 2$ to $x = 4$, which is the largest quantity?

- (I) L_2 (II) R_2 (III) T_2