University at Albany
State University of New York

AMAT112 Calculus I — Exam 2A — Spring 2025

Print Name:	
UAlbany Email:	

Directions: You have **75 minutes** to answer the following questions. ***You must show all necessary work*** as neatly and clearly as possible and clearly indicate your final answers.

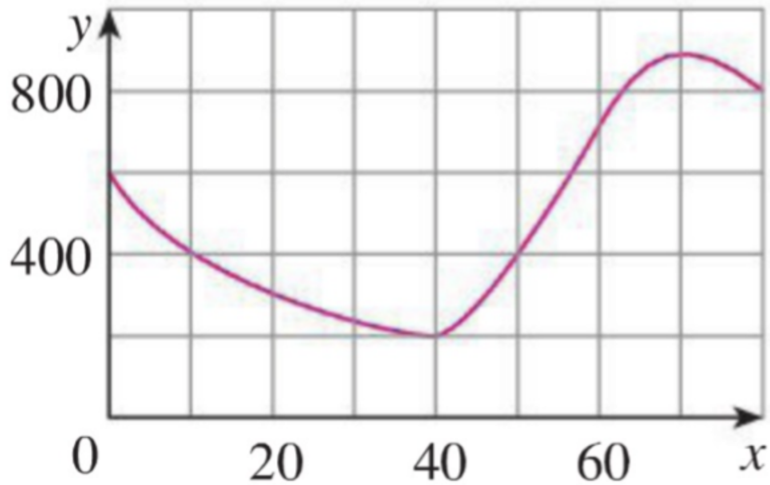
No calculators, notes, textbooks, mobile phones or other aids are allowed. Do not detach pages.

Problem	Possible	Points
1	5	
2	10	
3	10	
4	5	
5	10	
6	10	
Total	50	

YOUR SIGNATURE: ______

(Similar to Practice Assessment 5)

(1) Consider the graph of $f(x)$ below.



(a) (3 Points) Calculate the average rate of change of $f(x)$ on the interval $[10, 40]$.

(b) (2 Points) Use the graph to estimate the value of $f'(70)$.

(Similar to Practice Assessment 6)

(2) Compute the derivatives of each of the following functions. You **do not** have to simplify your final answer.

(a) (3 Points) $f(x) = 2\sin(x) - 3x^2 + \ln(x)$

(b) (3 Points) $g(x) = (2x^2 + 1)(e^x - 2)$

(c) (4 Points) $h(x) = (5 - 3x^4)^{-2}$

Your signature:

(Similar to Practice Assessment 8)

(3) (a) (5 Points) Calculate $\left.\frac{d}{dx}\left(f^{-1}(x)\right)\right|_{x=a}$ for the function:

$$f(x) = x^3 - 2x, \qquad a = 4.$$

(Hint: $f(2) = 4$)

(b) (5 Points) Find the derivative of each of $g(x) = \cos^{-1}(x^3)$.

YOUR SIGNATURE: ______________________________

(Similar to Practice Assessment 6)

(4) (5 Points) Suppose f and g are differentiable functions with values shown in the following table:

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
2	5	1	4	-1
3	4	7	-2	6

Find the exact value of $k'(3)$ if $k(x) = \dfrac{f(x)}{g(x)}$. Show all your work and simplify your final answer.

(Similar to Practice Assessment 7)

(5) Assume that y is a differentiable function of x and that $xy - 2x^2 + y^3 = 0$.

(a) (5 Points) Compute $\dfrac{dy}{dx}$.

(b) (5 Points) Find the equation of the tangent line to the curve given by $xy - 2x^2 + y^3 = 0$ at the point $(1, 1)$.

(Similar to Practice Assessment 10)

(6) Use logarithmic differentiation and/or the properties of logarithms to compute the derivative, y', of the following functions.

(a) (5 Points) $y = x^{\tan(x)}$

(b) (5 Points) $y = \ln\left(\dfrac{(x+2)^4(x-1)^3}{(x+1)^5}\right)$

YOUR SIGNATURE:

Formulas you might find useful

- **The derivative of a function**

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

- **Some rules of differentiation**

$$\frac{d}{dx}(cf(x)) = cf'(x)$$

$$\frac{d}{dx}(f(x)g(x)) = f'(x)g(x) + f(x)g'(x)$$

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$$

$$\frac{d}{dx} f(g(x)) = f'(g(x))g'(x)$$

- **The equation of the tangent line to a function f for $x = a$ is given by**

$$y = f(a) + f'(a)(x - a)$$

- **The derivative of the inverse function f^{-1} at $x = a$ is given by**

$$\frac{d}{dx}\left(f^{-1}(x)\right)\bigg|_{x=a} = \frac{1}{f'(f^{-1}(a))}.$$

- **Differentiation formulas**

$\frac{d}{dx}(x^n) = nx^{n-1}$	$\frac{d}{dx}(e^x) = e^x$	$\frac{d}{dx}(a^x) = (\ln a)a^x$
$\frac{d}{dx}(\ln x) = \frac{1}{x}$	$\frac{d}{dx}(\sin(x)) = \cos x$	$\frac{d}{dx}(\cos(x)) = -\sin x$
	$\frac{d}{dx}(\tan(x)) = \sec^2 x$	$\frac{d}{dx}(\cot(x)) = -\csc^2 x$
	$\frac{d}{dx}(\sec(x)) = \sec x \tan x$	$\frac{d}{dx}(\csc(x)) = -\csc x \cot x$
$\frac{d}{dx}(\sin^{-1}(x)) = \frac{1}{\sqrt{1-x^2}}$	$\frac{d}{dx}(\cos^{-1}(x)) = \frac{-1}{\sqrt{1-x^2}}$	$\frac{d}{dx}(\tan^{-1}(x)) = \frac{1}{1+x^2}$