

ID Check _____

Time Started _____

Name _____

Section/Professor _____

MAT 136: CALCULUS I
GATEWAY EXAM - VERSION B

Full Pass requires 7 or 8 problems; Half Pass 5 or 6. No partial credit

NO CALCULATOR OR SCRATCH PAPER

BOX FINAL ANSWERS

I have boxed acceptable answers.

In each case, find the derivative of the given function. It is not necessary to simplify the result algebraically.

1. $f(t) = t^2 e^{3t}$

$$f'(t) = 2t \cdot e^{3t} + t^2 \frac{d}{dt}[e^{3t}] \quad \leftarrow \text{Product rule}$$

$$= \boxed{2t e^{3t} + t^2 e^{3t} \cdot 3} \quad \leftarrow \text{chain rule}$$

2. $f(x) = \frac{\cos(x) - 2}{\cos(x) + 2}$

$$f'(x) = \frac{-\sin(x)(\cos(x) + 2) - (\cos(x) - 2)(-\sin(x))}{(\cos(x) + 2)^2}$$

If you had to simplify \rightarrow

$$= \frac{-\sin(x)\cos(x) - 2\sin(x) + \cos(x)\sin(x) - 2\sin(x)}{(\cos(x) + 2)^2}$$

$$= \boxed{\frac{-4\sin(x)}{(\cos(x) + 2)^2}}$$

3. $g(x) = \ln(\sin(x))$

$$g'(x) = \frac{1}{\sin(x)} \cdot \frac{d}{dx} \sin(x)$$

$$= \boxed{\frac{1}{\sin(x)} \cdot \cos(x)} = \boxed{\frac{\cos(x)}{\sin(x)}}$$

OK

4. $f(t) = \frac{t^3}{3} - \frac{1}{4t^3} = \frac{1}{3}t^3 - \frac{1}{4}t^{-3}$

$$f'(t) = \boxed{t^2 - \frac{1}{4}(-3)t^{-4}} = \boxed{t^2 + \frac{3}{4}t^{-4}}$$

$$5. f(x) = \sqrt{2 - \sin(x^2)} = (2 - \sin(x^2))^{\frac{1}{2}}$$

$$f'(x) = \frac{1}{2} (2 - \sin(x^2))^{-\frac{1}{2}} \cdot \frac{d}{dx} (2 - \sin(x^2))$$

$$= \frac{1}{2} (2 - \sin(x^2))^{-\frac{1}{2}} \cdot (-\cos(x^2)) \cdot \frac{d}{dx} (x^2)$$

$$= \boxed{-\frac{1}{2} (2 - \sin(x^2))^{-\frac{1}{2}} \cdot \cos(x^2) \cdot 2x} = \boxed{\frac{-x \cos(x^2)}{\sqrt{2 - \sin(x^2)}}}$$

$$6. f(x) = \arctan(3x)$$

$$f'(x) = \frac{1}{1 + (3x)^2} \cdot \frac{d}{dx} (3x) = \boxed{\frac{3}{1 + (3x)^2}} = \boxed{\frac{3}{1 + 9x^2}}$$

$$7. g(t) = 5^t = 5^{t^3} = e^{\ln(5^{t^3})} = e^{t^3 \ln(5)}$$

or, use $\frac{d}{dx} a^x = \ln(a) \cdot a^x$

$$g'(t) = e^{t^3 \ln(5)} \cdot \frac{d}{dt} (t^3 \ln(5))$$

$$= \boxed{e^{t^3 \ln(5)} \cdot 3t^2 \ln(5)} = \boxed{5^{t^3} \cdot 3t^2 \cdot \ln(5)}$$

$$8. f(x) = \tan^3(x) = (\tan(x))^3$$

$$f'(x) = 3 (\tan(x))^2 \cdot \frac{d}{dx} \tan(x)$$

$$= \boxed{3 (\tan(x))^2 \cdot \frac{1}{\cos^2(x)}} = \boxed{\frac{3 \tan^2(x)}{\cos^2(x)}} = \boxed{\frac{3 \sin^2(x)}{\cos^4(x)}}$$