

I. Multiple Choice

_____ 1. $\lim_{x \rightarrow 0} \frac{e^{3x} - e^{5x}}{x} =$

- A) -2 B) 0 C) 2 D) $\frac{3}{5}$ E) $+\infty$ F) 1

_____ 2. $\frac{d}{dx}(x^x) =$

- A) $(x)(x^{x-1})$ B) $(x)(x^x)$ C) $x^x(1 + \ln x)$ D) $\frac{1}{x}$
E) $1 + \ln x$

_____ 3. If $\ln x - \ln\left(\frac{1}{x}\right) = 2$, then $x =$

- A) $\frac{1}{e^2}$ B) $\frac{1}{e}$ C) $2e$ D) e E) e^2

_____ 4. If $y = \text{Arcsin}(2x)$, Then $\frac{dy}{dx} =$

- A) $\frac{-1}{2\sqrt{1-4x^2}}$ B) $\frac{-2}{\sqrt{4x^2-1}}$ C) $\frac{1}{2\sqrt{1-4x^2}}$ D) $\frac{2}{\sqrt{1-4x^2}}$
E) $\frac{2}{\sqrt{4x^2-1}}$

_____ 5. Let $f(x) = \cos(\text{Arctan } x)$. What is the **range** of f ?

- A) $-\frac{\pi}{2} < y < \frac{\pi}{2}$ B) $0 < y \leq 1$ C) $0 \leq y \leq 1$
D) $-1 < y < 1$ E) $-1 \leq y \leq 1$

- _____ 6. Boats A and B leave the same place at the same time. Boat A heads due North at 12 km/hr. Boat B heads due East at 18 km/hr. After 2.5 hours, how fast is the distance between the boats increasing (in km/hr)?
 A) 21.63 B) 31.20 C) 75.00 D) 9.84 E) 54.08
- _____ 7. If $f(x) = \frac{x}{x+1}$, then the inverse function, f^{-1} , is given by $f^{-1}(x) =$
 A) x B) $\frac{x-1}{x}$ C) $\frac{x+1}{x}$ D) $\frac{x}{1-x}$ E) $\frac{x}{x+1}$
- _____ 8. $\cos(\sin^{-1} x) =$
 A) $1-x^2$ B) $1+x^2$ C) $\sqrt{1-x^2}$ D) $\frac{1-x^2}{x}$ E) $\frac{1}{\sqrt{1-x^2}}$
- _____ 9. If $y = x^2 e^x$, Then $\frac{dy}{dx} =$
 A) $2x + e$ B) $2xe^x$ C) $x(x + 2e^x)$ D) $xe^x(x + 2)$
 E) $2x + e^x$
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II. Free Response Show all work.

10. Give the **exact value** of $\sin\left(\sin^{-1}\left(\frac{2}{5}\right) + \cos^{-1}\left(\frac{5}{13}\right)\right)$

11. Determine $\frac{d}{dx}\left(\cos^{-1}(2e^{3x})\right)$

12. Determine $\frac{dy}{dx}$ if $x^2 - 4xy^3 = y$

13. $\lim_{x \rightarrow -3} \left(\frac{x^3 + 27}{x + 3} \right) =$

14. Sketch the graph of $y = \text{Cos}^{-1}x$
15. Derive the formula for the derivative of $y = \text{Tan}^{-1}x$
16. A rectangular swimming pool is 40 feet long, 20 feet wide, and 8 feet deep. If the pool is filled by pumping water into it at the rate of 40 cubic feet per minute, how fast is the water level rising when it is 3 feet deep?
17. Determine the derivative of $y = 5^x$.
18. Determine the derivative of $y = x^{7e}$.
19. Determine the number of years it takes to accumulate \$1,000 if you start with \$700 invested at 5.25% compounded quarterly.

Use the compound interest formula: $A = P\left(1 + \frac{r}{m}\right)^{mt}$

20. $\lim_{x \rightarrow -1} \left(\frac{x^2 - 1}{x^3 + 1} \right) =$

Extra Credit: Determine the effective Annual Yield of 5% compounded quarterly.