

Problem Set 2 ICMAB 2017

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. If  $\frac{dy}{dx} = \frac{3}{4x \ln x}$ , then  $y =$
- A.  $3 \ln 4x + C$                       B.  $4x \ln 3x + C$   
 C.  $\frac{3}{4} e^{\ln x} + C$                       D.  $\frac{3}{4} \ln(\ln x) + C$
2. If  $y = e^{\ln(\cos x)}$ , then  $\frac{dy}{dx} =$
- A.  $\ln(\cos x)$                       B.  $-\sin x$   
 C.  $\frac{\sin x}{\ln x}$                       D.  $-\frac{\sin x}{\ln x}$
3. Let  $f$  and  $g$  be mutually inverse functions. If  $f'(3) = 4$ , what is the value of  $g'(4)$ ?
- A.  $\frac{1}{4}$   
 B.  $\frac{1}{3}$   
 C. 3  
 D. not enough information
4. Suppose  $f(x) = x^2 - x - 2$  and let  $h(x)$  be the inverse of  $f$ . Find  $h'(4)$  if  $x > 0$ .
- A.  $\frac{1}{5}$                       B. 5                      C.  $\frac{1}{7}$                       D.  $-\frac{1}{7}$
5. If  $y = \cos(e^x)$ , then  $\frac{dy}{dx} =$
- A.  $e^x \sin e^x$                       B.  $-e^x \sin e^x$   
 C.  $x \sin e^x$                       D.  $2e^x \sin x$
6. What is the slope of the tangent line to  $3xy - 5 \ln 4x = \frac{3}{4}$  at the point  $(\frac{1}{4}, 1)$ ?
- A.  $\frac{68}{3}$                       B.  $-\frac{68}{3}$                       C.  $\frac{3}{92}$                       D. -17
7. Find  $\frac{dy}{dx}$  for  $y = \ln \sqrt{x^2 + 4}$ .
- A.  $\frac{x}{\sqrt{x^2 + 4}}$                       B.  $\frac{2x}{\sqrt{x^2 + 4}}$   
 C.  $\frac{x}{x^2 + 4}$                       D.  $e^x \cdot e^{x^2 + 4}$

8. Evaluate:  $\int \frac{1 - \sin x}{\cos x} dx$

- A.  $\ln |1 + \sin x| + C$       B.  $x + \cot x + C$   
 C.  $\ln |1 - \sin x| + C$       D.  $\ln |1 + \cos x| + C$

9. If  $y = e^{\sin x}$ , then  $\frac{dy}{dx} =$

- A.  $-e^{\cos x} \sin x$       B.  $\cos x e^{\sin x}$   
 C.  $e^x \cos x$       D.  $-\cos x e^{\sin x}$

10.  $\int \frac{\ln(5x)}{x} dx =$

- A.  $\frac{1}{5} \ln 5x - x + C$       B.  $\frac{1}{2} (\ln 5x)^2 + C$   
 C.  $\frac{1}{5} \ln \frac{1}{5} x + C$       D.  $5x \ln 5x + C$

11. If  $y = \ln \frac{2x}{3x+4}$ , then  $\frac{dy}{dx} =$

- A.  $\frac{4x}{(3x+4)}$       B.  $\frac{4}{x(3x+4)}$   
 C.  $\frac{3x+1}{x(3x+4)}$       D.  $\frac{-3}{x(2x-3)}$

12.  $\int \frac{\ln x}{2x} dx =$

- A.  $\frac{(\ln x)^2}{4} + C$       B.  $\frac{x \ln x}{2} + C$   
 C.  $x \ln x + C$       D.  $\sqrt{x} \ln x + C$

13. If  $y = \ln(e^{2x^2} + 1)$ , then  $\frac{dy}{dx} =$

- A.  $\frac{x e^{2x^2}}{e^{2x^2} + 1}$       B.  $\frac{4x e^{2x^2}}{e^{2x^2} + 1}$   
 C.  $\frac{4e^{2x^2}}{e^{2x^2} + 1}$       D.  $\frac{4x^2 e^{x^2}}{e^{2x^2} + 1}$

14. Find the derivative of  $f(x) = \ln \frac{x(x^2+2)}{\sqrt{x^3-7}}$ .

- A.  $\frac{x^2+2}{x} + \frac{2x^2}{x^2+2} + \frac{3x^2}{2(x^3-7)}$   
 B.  $\frac{1}{x} + \frac{2x}{x^2+2} - \frac{3x^2}{2(x^3-7)}$   
 C.  $\frac{1}{x} + \frac{2x}{x^2+2} + \frac{3x^2}{2(x^3-7)}$   
 D.  $\frac{1}{x} - \frac{2x}{x^2+2} + \frac{3x^2}{2(x^3-7)}$

15. If  $y = \ln(e^{3x} - 5)$ , then  $\frac{dy}{dx} =$

A.  $\frac{1}{e^{3x} - 5}$

B.  $\frac{1}{e^{3x}}$

C.  $\frac{3x - 5}{e^{3x} - 5}$

D.  $\frac{3e^{3x}}{e^{3x} - 5}$

16. Evaluate:  $\int \frac{\sin(\ln x)}{x} dx$

A.  $\cos(\ln x) + C$

B.  $\tan(\ln x) + C$

C.  $-\cos(\ln x) + C$

D.  $-\sin(\ln x) + C$

17.  $\int \sec 2x dx =$

A.  $\frac{1}{2} \ln |\sec 2x + \tan 2x| + C$

B.  $2 \csc 2x + C$

C.  $\frac{1}{4} \csc 2x + C$

D.  $\frac{1}{2} \ln |\tan 2x| + C$

18. If  $y = \ln(\sqrt{x^2 + 1} + x)$ , then  $\frac{dy}{dx} =$

A.  $\frac{1}{\sqrt{1-x^2}}$

B.  $\frac{1}{\sqrt{1+x^2}}$

C.  $\frac{1}{1-x^2}$

D.  $\frac{-1}{\sqrt{1-x^2}}$

19. If  $y = e^{5/x}$ , then  $y' =$

A.  $-\frac{5e^{5/x}}{x^2}$

B.  $e^{5/x}$

C.  $\ln\left(\frac{5}{x}\right)$

D.  $xe^{5/x}$

20. Find  $y'$  given  $y = e^{\cos \sqrt{x}}$ .

A.  $-\frac{\sin \sqrt{x}}{2\sqrt{x}} e^{\cos \sqrt{x}}$

B.  $(\sin \sqrt{x})e^{\cos \sqrt{x}-1}$

C.  $\frac{e^{\cos \sqrt{x}}}{2\sqrt{x}}$

D.  $-\frac{(\sin \sqrt{x})e^{\cos \sqrt{x}}}{\sqrt{x}}$

21. Suppose  $f(x) = x^3$  and let  $h(x)$  be the inverse of  $f$ . Find  $h'(-8)$ .

A.  $\frac{1}{12}$

B. 12

C.  $\frac{1}{6}$

D.  $-\frac{1}{12}$

22.  $\int \csc 3x \, dx =$

- A.  $-\frac{1}{3} \ln |\csc 3x + \cot 3x| + C$
- B.  $\frac{1}{3} \csc^2 3x + C$
- C.  $\frac{1}{3} \ln |\csc 3x + \cot 3x| + C$
- D.  $\frac{1}{\ln} |\cot 3x| + C$

23. A wandering child travels along a sidewalk so that its position at any time is  $s(t) = 4 \sin 2t + \ln(5x + 3) + \cos x$  on the interval  $[2, 6]$ . How many times does the child change direction?

- A. 1
- B. 2
- C. 3
- D. 0

24. If  $\frac{dy}{dx} = \frac{6x + 5}{3x^2 + 5x - 2}$ , then  $y =$

- A.  $\ln |3x^2 + 5x - 2| + C$
- B.  $\arctan(3x^2 + 5x - 2) + C$
- C.  $\arcsin(3x^2 + 5x - 2) + C$
- D.  $6x \ln(3x^2 + 5x - 2) + C$

25. The average value of  $f(x) = \frac{x^2 - 4}{x}$  on the closed interval  $[1, e]$  is

- A.  $\frac{e^2 - 9}{2}$
- B.  $\frac{e^2 - 9}{2(e - 1)}$
- C.  $\frac{e^2 - 3e - 4}{e}$
- D.  $\frac{1}{2}e^2 - 9$

26. Evaluate the indefinite integral:  $\int \frac{1}{x^2 e^{5/x}} \, dx$

- A.  $\frac{1}{5} e^{5/x} + C$
- B.  $\frac{1}{5} x e^{5/x} + C$
- C.  $\frac{1}{5} e^{-5/x} + C$
- D.  $-\frac{1}{6x^3 e^{5/x}} + C$

27. If  $y = \sin(x \ln x)$ , then  $\frac{dy}{dx} =$

- A.  $-\cos(x \ln x) \ln x - \cos(x \ln x)$
- B.  $\sin(x \ln x) \ln x + \sin(x \ln x)$
- C.  $\sin(x \ln x) + \sin(x \ln x)$
- D.  $\cos(x \ln x) \ln x + \cos(x \ln x)$

28. If  $y = e^{x^3+5x}$ , then  $y' =$

- A.  $(3x^2 + 5)e^{x^3+5x}$       B.  $3x^2 + 5$   
C.  $(x^3 + 5x)e^{x^3+5x}$       D.  $(3x^2 + 5)e^{3x^2+5}$

29. Find the derivative of  $f(x) = \ln(x^4 - 4x)^4$ .

- A.  $\frac{16(x^3 - 1)}{x(x^3 - 4)}$   
B.  $\frac{16(x^3 - 4)}{x(x^3 - 4x)}$   
C.  $\frac{4(x^3 - 1)}{x(x^3 - 4)}$   
D.  $\frac{1}{16(x^3 - 1)(x^4 - 4x)^3}$

30. Differentiate with respect to  $x$ :  $y = e^{7-(5/x)}$

- A.  $\frac{dy}{dx} = -e^{7-(5/x)}$       B.  $\frac{dy}{dx} = e^{7-(5/x)}$   
C.  $\frac{dy}{dx} = \frac{5}{x^2}e^{7-(5/x)}$       D.  $\frac{dy}{dx} = e^{6-(5/x)}$