

$$1 + \frac{5}{4} \ln(3)$$

$$\frac{4}{5} \ln(3) + \frac{8}{3} \ln(3) =$$

$$\left( \frac{8}{3} \ln(3) - 3 + \frac{5}{4} \cdot \ln(3) \right) - \left( \frac{8}{3} \ln(3) - 1 - \frac{5}{4} \cdot \ln(3) \right) =$$

$$= \left( \frac{8}{3} (3)^2 - 3 + \frac{5}{4} \cdot \ln(3) \right) - \left( \frac{8}{3} (1)^2 - 1 - \frac{5}{4} \cdot \ln(1) \right) =$$

~~$$\frac{1}{3} \left[ x^2 + \frac{5}{4} \ln|x| \right] =$$~~

$$\frac{1}{2} \left[ \frac{3}{4} x^2 - 2x + \frac{5}{2} \ln|x| \right] =$$

$$\frac{1}{2} \int_3^1 \frac{3x}{2} - 2 + \frac{5}{2} x \, dx$$

$$36. \quad \frac{1}{3x^2 - 4x + 5} \int_{3-1}^{2x} \, dx$$

$$3 \left[ u + \ln(e^{2x+1}) \right]_0^6$$

~~10. 2x + 1~~

$$= \frac{1}{2} \left[ e^{2x+1} \right]_0^6 = \frac{1}{2} \left[ (-\ln(2)) - (\ln(e^6-1)) \right]$$

$$= \frac{1}{2} \int_3^6 e^u \, du$$

$$dx = 2e^{2x}$$

$$du = e^{2x} \, dx$$

$$u = e^{2x} + 1$$

$$35. \quad \frac{1}{2} \int_{e^{2x+1}}^{3-0} \, dx$$

35.

$$= \frac{1}{4} \left[ e^{2x} - e^{-2x} \right]_3^4$$

$$= \frac{1}{4} \int e^u du$$

$$\begin{aligned} x dx &= dm = x^2 dx \\ dm &= 9x^2 \\ u &= 3x^3 \end{aligned}$$

$$34. \int_{-2}^1 x^2 \cdot e^{3x^3} dx$$

$$= \frac{1}{2} \left[ \ln(1+e^2) - \ln(2) \right]$$

$$= \frac{1}{2} \left[ \ln(1+e^2) - \ln\left(\frac{2}{1+e^2}\right) \right]$$

$$= \frac{1}{2} \int_1^2 \frac{du}{u}$$

$$\frac{dx}{2} dm = e^{2x} dx$$

$$dm = 2e^{2x} dx$$

$$u = 1 + e^{2x}$$

$$33. \int_1^0 \frac{e^{2x}}{1+e^{2x}} dx$$

$$= -\frac{1}{4} \left[ e^4 - e^8 \right] = 731.59$$

$$x dx = -\frac{1}{4} du$$

$$= -\frac{1}{4} \int e^u du = e^{-4x}$$

$$\begin{aligned} \frac{dx}{x} &= -\frac{du}{4} \\ u &= -4x \end{aligned}$$

$$32) \int_{-1}^{-2} x^{-4x} dx$$

$$\left[ \ln\left(\frac{u}{2}\right) - \ln\left(\frac{u-2}{2}\right) \right] = \frac{1}{2} \left[ \ln(2x^3) - \ln(2) \right] = \frac{1}{2} \ln(2x^3) =$$

$$\frac{1}{2} du = 3x^2 dx$$

$$du = 6x^2 dx$$

$$u = 2x^3 - 4$$

$$2 - e^{-x} + 1 + e^{-x} - 0 - 2 + 1$$

$$(x+1|\ln|) - (x+e^x) =$$

$$\int_{e^x}^1 \frac{1}{x+e^x} dx = \ln|x+e^x|$$

30.

$$\int \frac{1}{n} dx =$$

$$\int \frac{\sec^2 x}{1+\tan x} dx$$

29.

$$x^2 dx = u^{\frac{3}{2}} du$$

$$du = 3x^2 dx$$

$$u = \cancel{x^3} =$$

$$x^{\frac{3}{2}} + C$$

$$\int x^{\frac{3}{2}} du =$$

$$28. \int x^2 \cdot e^{x^3} dx$$

$$27. \int \frac{x^4 - x^4}{x^3} dx$$

$$24. \int e^{\cos x} \sin x dx$$

$\frac{d}{dx} u = \cos x$

$$u = \cos x$$

$$du = -\sin x dx$$

$$\int e^u du = -e^u + C$$

$$= -\int e^u du = -e^{\cos x} + C$$

$$25. \int \frac{u}{e^x+1} du$$

$\frac{d}{dx} u = e^x$

$$u = e^x + 1$$

$$du = e^x dx$$

$$= \ln(e^x + 1) + C$$

$$24. \int \frac{5x^3 - 4x - 3}{3x^2} dx$$

$$= \int \frac{5x^2}{3x^2} dx - \frac{4}{3x^2} dx - \frac{3}{3x^2} dx$$

$$= \frac{5}{3}x^2 - \frac{4}{3}\ln|x| + \frac{1}{x} + C$$

$$23. \int e^x + x^3 dx$$

$$= e^x + \frac{1}{4}x^4 + C$$

$$22. \int \frac{x}{x^2 + 9} dx$$

$$u = x^2 + 9$$

$$du = 2x dx$$

$$\frac{1}{2} du = x dx$$

$$= \frac{1}{2} \ln|x^2 + 9| + C$$

$$21. \int \frac{4x - 5}{2} dx$$

$$u = 4x + 5$$

$$du = 4 dx$$

$$\frac{1}{4} du = x dx$$

$$= \frac{1}{2} \ln|4x + 5| + C$$

$$34. \int_{-3}^1 x^2 e^{3x^2} dx = \frac{2x}{3x^2 - 4x + 5}$$

$$35. \int_0^3 \frac{e^{2x}}{e^{2x} + 1} dx = \int_0^3 \frac{e^{2x}}{1 + e^{2x}} dx$$

Find the average value of the function on the given interval.

$$y + 54.074 = -168.908(x-2)$$

$$= -54.074$$

$$\arcsin\left(\frac{x}{2}\right) - e^x$$

now find y-value:

$$f(x) = -168.908$$

$$f(x) = \frac{1}{1 - \frac{x^2}{4}} - 2e^{-2x}$$

$$(26) \quad f(x) = \arcsin\left(\frac{x}{2}\right) - e^{-2x}$$

$$(21) \quad u = 4x + 5 \quad du = 4 dx \quad \frac{1}{2} \ln|4x+5| + C$$

$$\begin{aligned} 27. \int \frac{\sqrt{4-x^2}}{x^3} dx &= \int \frac{\sqrt{4-x^2}}{x^3} \sin x dx \\ 28. \int x^2 e^{x^3} dx &= \int e^{cos x} \sin x dx \\ 29. \int \frac{1+tan x}{sec^2 x} dx &= \int \frac{e^x + 1}{e^x} dx \\ 30. \int \frac{x}{1+e^x} dx &= \int x^2 e^{3x^2} dx \\ 31. \int \frac{3x^2}{e^{2x}-4} dx &= \int \frac{1}{e^{2x}+1} dx \\ 32. \int_{-1}^2 e^{-4x} dx &= \int_1^2 x^2 e^{3x^2} dx \\ 33. \int_1^3 \frac{1+e^{2x}}{e^{2x}} dx &= \int_{-2}^1 x^2 e^{3x^2} dx \\ 34. \int_{-1}^1 x^2 e^{3x^2} dx &= \int_{-3}^1 x^2 e^{3x^2} dx \end{aligned}$$

Evaluate each definite integral.

$$\begin{aligned} 21. \int \frac{4x-5}{2} dx &= 24. \int \frac{3x^2-4x-3}{5x^3-4x-3} dx \\ 22. \int \frac{x^2+9}{x} dx &= 23. \int (e^x + x^3) dx \\ 23. \int (e^x + x^3) dx &= 25. \int \frac{e^x+1}{e^x} dx \\ 24. \int \frac{3x^2-4x-3}{5x^3-4x-3} dx &= 26. \int e^{\cos x} \sin x dx \\ 25. \int \frac{e^x+1}{e^x} dx &= 27. \int \frac{\sqrt{4-x^2}}{x^3} dx \\ 26. \int e^{\cos x} \sin x dx &= 28. \int x^2 e^{x^3} dx \\ 27. \int \frac{\sqrt{4-x^2}}{x^3} dx &= 29. \int \frac{1+tan x}{sec^2 x} dx \\ 28. \int x^2 e^{x^3} dx &= 30. \int \frac{x}{1+e^x} dx \\ 29. \int \frac{1+tan x}{sec^2 x} dx &= 31. \int \frac{3x^2}{e^{2x}-4} dx \\ 30. \int \frac{x}{1+e^x} dx &= 32. \int_{-1}^2 e^{-4x} dx \\ 31. \int \frac{3x^2}{e^{2x}-4} dx &= 33. \int_1^3 \frac{1+e^{2x}}{e^{2x}} dx \\ 32. \int_{-1}^2 e^{-4x} dx &= 34. \int_{-1}^1 x^2 e^{3x^2} dx \\ 33. \int_1^3 \frac{1+e^{2x}}{e^{2x}} dx &= 35. \int_0^3 \frac{e^{2x}}{e^{2x}+1} dx \\ 34. \int_{-1}^1 x^2 e^{3x^2} dx &= 36. \int_{-3}^1 x^2 e^{3x^2} dx \end{aligned}$$

Evaluate each indefinite integral.

Find the derivative.

$$9. y' = 4e^{4x} - \frac{1}{x} - \frac{1}{x\sqrt{x^2-1}}$$

$$10. f(x) = e^{4x} - \ln|x| - \arcsin x$$

$$11. g(x) = \arccos 3x - e^x + \ln \sqrt{x}$$

$$12. f(x) = \frac{x^2}{e^{2x}}$$

$$13. f(x) = e^{4x} + \arcsin(\ln x)$$

$$14. g(x) = \ln(e^{3x}-1) + \ln|5x-2|$$

$$15. f(x) = e^x \operatorname{arccot}(e^x)$$

$$16. y = e^{2x} \ln|2x|$$

$$17. g(x) = e^{3x^2} \arctan 5x$$

$$18. y = \frac{\ln|x-3|}{x-3}$$

$$16. \frac{1}{2} e^{2x} \cdot 2 + 2e^{2x} \ln|2x|$$

$$12. \frac{2xe^{2x} - 2x^2 e^{2x}}{(e^{2x})^2} = \frac{2x - 2x^2}{e^{2x}}$$

$$14. \frac{1}{e^{3x}-1} \cdot 3e^{3x} + \frac{1}{5x-2} \cdot 5 \\ = \frac{3e^{3x}}{e^{3x}-1} + \frac{5}{5x-2}$$

$$18. (x-3) \cdot \frac{1}{(x-3)} - \ln|x-3|$$

$$\cancel{(x-3)^2}$$

$$\frac{1 - \ln|x-3|}{(x-3)^2}$$

$$19. f(x) = \arctan x + 3 \ln x$$

$$x=1$$

$$20. f(x) = \arcsin\left(\frac{x}{4}\right) - e^{2x}$$

$$x=2 \text{ (next page)}$$

$$17. e^{3x^2} \cdot \frac{5}{25x^2+1} + 6x e^{3x^2} \operatorname{arctan} 5x$$

$$= e^{3x^2} \left[ \frac{5}{25x^2+1} + 6x \operatorname{arctan} 5x \right]$$

$$13. 4e^{4x} + \frac{1}{x\sqrt{(inx)^2-1}} \\ \frac{1}{1-(inx)^2}$$

$$16. \frac{-3}{\sqrt{9x^2-1}} - e^x + \frac{1}{2\sqrt{x}}$$

$$19. \text{METHW } (1, \pi/4) \quad y - \frac{\pi}{4} = \frac{1}{2}(x-1)$$

$$f'(x) = \frac{1}{x^2+1} + \frac{3}{x}$$

$$= \frac{1}{2} + \frac{3 \cdot 2}{1 \cdot 2} = \frac{1}{2} + \frac{4}{2} = \boxed{7/2}$$

$$15. e^x \cdot \frac{-1}{e^{2x}+1} \cdot e^x + \operatorname{arccot}(e^x) - e^x$$

$$\frac{-e^{2x}}{e^{2x}+1} + \operatorname{arccot}(e^x) e^x$$

(E)  $\frac{\sqrt{1-16x^2}}{4}$

(D)  $\frac{1}{\sqrt{1-16x^2}}$

(C)  $\frac{4}{1+16x^2}$

(B)  $\frac{1}{1+16x^2}$

(A)  $4\cos^{-1}(4x)$

Q. If  $y = \sin^{-1}(4x)$ , then  $\frac{dy}{dx} =$

(E)  $x > 0$

(D)  $x > -1$

(C)  $x < -1$

(B)  $x > -2$

(A)  $x < -2$

7. Let  $f$  be a function given by  $f(x) = 2xe^x$ . The graph of  $f$  is concave up when

(E)  $-\frac{1}{3}$

(D)  $\frac{1}{6}$

(C) 0

(B)  $-\frac{1}{6}$

(A)  $-\frac{1}{3}$

Q. If  $f(x) = \ln(x + 5 + e^{-2x})$ , then  $f'(0) =$

$$\frac{6}{1-2e^0} = \frac{x+5+e^{-2x}}{1-2e^{-2x}} =$$

$$\frac{x+5+e^{-2x}}{1-2e^{-2x}}$$

$$\left[ \frac{1}{1} - \frac{5}{e^{-5}} \right] e^{\frac{5}{1}} = \int_1^\infty \left( x - 5 \right) e^{-\frac{5}{x}}$$

$$\frac{5}{1} + \frac{5}{e^{-5}} - \frac{5}{e^{-5}} x$$

$$\int_1^\infty e^{-u} du$$

$$dx = -\frac{5}{1} du$$

$$x \frac{du}{dx} = -\frac{5}{1}$$

$$x = -\frac{5}{1} u$$

~~$$-\frac{5}{1} e^{-\frac{5}{x}} + 5 e^0$$~~

- (E)  $5 - 5e^{-5}$   
 (D)  $\frac{5}{1} e^{-5}$   
 (C)  $\frac{5}{1} - \frac{5}{e^{-5}}$   
 (B)  $-5e^{-5}$   
 (A)  $\frac{5}{-e^{-5}}$

$$5 \cdot \int_1^0 e^{-5x} dx$$

$$(E) -\frac{2}{3}$$

$$(D) -\frac{1}{2}$$

$$(C) 0$$

$$(B) \frac{3}{2}$$
  

$$(A) \frac{1}{2}$$

4. What is the slope of the tangent line to the curve  $y = \arctan(3x)$  at the point at which  $x = \frac{1}{3}$ ?

$$y' = \frac{1}{1 + (3x)^2} \cdot 3$$

$$\frac{9x^2 + 1}{3}$$

## AP Calculus

## Test Review: Chapter 5

Name Key  
 Date \_\_\_\_\_ Block \_\_\_\_\_

1. If  $f(x) = x^2 - 2x$ , then  $\frac{d}{dx}[f(\ln x)] =$

$$(1/x)^2 - 2\ln x$$

(A)  $2x \ln x - 2x$

(B)  $2 \ln x - 2$

(C)  $2 \ln x - \frac{2}{x}$

(D)  $\frac{2 \ln x - 2}{x}$

(E)  $\frac{2x - 2}{x}$

$$2 \ln x \cdot \frac{1}{x} - \frac{2}{x}$$

$$\frac{2 \ln x - 2}{x}$$

2. If  $g(x) = e^{(3/x)}$ , then  $g'(x) =$

(A)  $e^{(3/x)}$

(B)  $e^{(-3/x^2)}$

(C)  $-\frac{3}{x^2} e^{(3/x)}$

(D)  $-3x^2 e^{(3/x)}$

(E)  $3e^{(3/x)} \ln x$

$$-\frac{3}{x^2} e^{(3/x)}$$

3.  $\int \frac{x}{x^2 - 5} dx =$

$$u = x^2 - 5$$

(A)  $\frac{-1}{4(x^2 - 5)^2} + C$

$$du = 2x dx$$

$$\frac{1}{2} \cancel{dx} \rightarrow \frac{1}{2} \int \frac{1}{u}$$

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

$$\frac{1}{2} \ln|x^2 - 5| + C$$

(C)  $\ln|x^2 - 5| + C$

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

(E)  $\frac{1}{2} \arctan\left(\frac{x}{2}\right) + C$