1. Let $f(x) = \ln (x^3 + e^x)$. Find $f'(x)$.

a. $\frac{3x^2 + e^x}{x^3 + e^x}$ b. $x^{1/3} + e^x$ c. $\frac{3}{x} + 1$ d. $x^3 e^x$

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

2. If the function $y = f(x)$ satisfies the differential equation $y' = 5y$ and $f(0) = 10$ then $f(x)$ equals

a. $10 e^{5x}$ b. $2 e^{5x}$ c. $10 e^{10x}$ d. $10 e^{2x}$ e. $10 e^{-5x}$

3. Use implicit differentiation to calculate $\frac{dy}{dx}$ when $x^3 + 3xy + y^3 = 7$.

a. $\frac{-x^2 - y}{x + y^2}$ b. $\frac{x + y^2 - 7}{x^2 + y}$ c. -1 d. $\frac{x^2 + y - 7}{x + y^2}$

e. $\frac{-x^2 - y}{y^2}$

4. Find the slope of the tangent line to the curve $2x^4 - 3y^4 + 1 = 0$ at the point (1,1).

a. $\frac{2}{3}$ b. $\frac{3}{4}$ c. $\frac{1}{2}$ d. $\frac{3}{2}$ e. $\frac{4}{3}$

5. Compute the derivative of the function $f(x) = e^{x^2 + \ln x}$ at $x = 1$.

a. 3e b. 2e c. 0 d. 1 + 2e e. 1 + 3e

6. If $y = \sqrt{1-u^2}$ and $u = 2x$, use the Chain Rule to compute $\frac{dy}{dx}$.

a. $\frac{-4x}{\sqrt{1-4x^2}}$ b. $\frac{-2x}{\sqrt{1-4x^2}}$ c. $\frac{2}{\sqrt{1-4x^2}}$

d. $\frac{2x}{\sqrt{1-4x^2}}$ e. $\frac{4x}{\sqrt{1-4x^2}}$

7. The function $f(x) = \frac{x}{e^{2x}}$ has only one relative extreme point.

Find the x– coordinate of this point.

a. $\frac{1}{2}$ b. 1 c. 0 d. 2 e. $-\frac{1}{2}$

8. Find the derivative of $f(x) = \ln\left(\frac{x^2}{x^2 - 3}\right)$ at $x = 2$.

a. – 3 b. – 2 c. – 1 d. 0 e. 5

9. Find the derivative of $f(x) = e^{2x} \ln x^2$.

a. $2e^{2x}\left(\ln(x^2) + \frac{1}{x}\right)$ b. $e^{2x}\left(2\ln(x^2) + \frac{1}{x}\right)$ c. $e^{2x}\left(\ln(x^2) + \frac{2}{x}\right)$

d. $e^{2x}\left(2\ln(x^2) - \frac{1}{x}\right)$ e. $e^{2x}\left(\ln(x^2) - \frac{2}{x}\right)$

10. Find the derivative of the function $y = x^x$. Hint: Take the natural logarithm of both sides of the equation and then differentiate.

a. $x^x (\ln x + 1)$ b. x^x c. $e^x \ln x$ d. $\ln x + 1$

e. $x \ln x$

11. Solve the equation $\ln\left(\ln (x) + \ln (x^2)\right) = 0$ for x.

a. $e^{1/3}$ b. 1 c. $e + e^{1/2}$ d. $-2 \ln 2$

e. 17/11

12. The value of $e^{\ln(5 + 7 \ln (e))}$ is:

a. 12 b. 0 c. $e^5 + 7 e^2$ d. $e^5 + 2 e^7$

e. 5

13. Solve the equation $(e^{x+1})^2 = 4$ for x.

a. $\ln 2 - 1$ b. 2 c. $\ln 2$ d. e^4 e. $2\sqrt{e}$

14. The value of $\ln(1) + e^0 + \ln(e)$ is the same as

a. 2 b. 1 c. 0 d. e e. none of the above

15. Suppose that $F(x) = f(g(x))$ and

$g(3) = 6$ $g'(3) = 4$ $g'(6) = 2$

$f(3) = 5$ $f'(3) = 7$ $f'(6) = 8$

find $F'(3)$.

a. 32 b. 30 c. 7 d. 28 e. 14

16. Suppose you put \$1000 into a bank account which receives 10% annual interest compounded continously. How many years will it take before your bank account has \$3000 ?

a. $10 \ln 3$ b. $-10 \ln 3$ c. $(\ln 10)(3)$ d. $\frac{10}{\ln 3}$ e. $\frac{1}{3} e^{1/10}$

17. Suppose you want to have \$20, 000 in your bank account after 5 years. If the account pays 10% annual interest compounded continuously, how much should you initially deposit into the account?

a. $20,000\ e^{-1/2}$ b. $\frac{\ln (20,000)}{5}$ c. $5\ (20,000)\ e^{1/10}$

d. $4,000\ e^{-1/10}$ e. $4,000$

18. The population of a colony of bacteria is given by the formula $P(t) = P_0\ e^{kt}$ where P_0 is the population at time t=0, t is measured in days and k is the growth constant of the colony. If the population of the colony triples after 20 days, find the growth constant for the colony.

a. $\frac{\ln 3}{20}$ b. $\frac{20}{3} e$ c. $e^{20} - e^0$ d. $\frac{20}{3 \ln 3}$ e. $\frac{3}{\ln 20}$

19. Recall that radioactive decay satisfies the equation $P(t) = P_0 e^{-\lambda t}$ where λ denotes the decay constant. Assume the decay constant for a radioactive substance is 7 (when time is measured in years). If the initial amount of the radioactive substance is 100 grams, how many years will it take until the amount of radioactive substance is 10 grams ?

a. $\frac{\ln (.1)}{-7}$ b. $(7)(90)$ c. $100\, e^{7}$ d. $\frac{\ln (7)}{100}$ e. $\frac{\ln (7)}{-10}$

20. A point is moving along the graph of $x^2 + y^2 = 5$. When it is at the point (1, 2), its y – coordinate is increasing at the rate of 5 units per second. At what rate is its x – coordinate changing in units per second at this moment?

a. – 10 b. 5/2 c. – 2/5 d. 5 e. – 2