

1. Solve for  $x$ :  $x^{\ln x} = e$

2. Solve for  $x$ :  $3e^{2x} = 15$

3. Solve for  $x$ :  $\ln x^2 - \ln(2x) + 1 = 0$

4. Solve for  $x$ :  $(6 + 4x)e^x - e^x(5x + 7) = 0$

5. Solve for  $x$ :  $\ln \sqrt{x} - 2 \ln 3 = 0$

6. Which is larger,  $2\ln(5)$  or  $3\ln(3)$ ?

7. Which is larger,  $\frac{1}{2}\ln(16)$  or  $\frac{1}{3}\ln(27)$ ?

8. Differentiate:  $y = \ln\left(\frac{x}{7-4x^3}\right)$

9. Differentiate:  $f(x) = \ln\left[\frac{e^x \sqrt{x+1} (x^2 + 2x + 3)^2}{4x^2}\right]$

10. Logarithmically differentiate:  $f(x) = 10^x$

11. Logarithmically differentiate:  $f(x) = (x^2 + 5)^6 (x^3 + 7)^8 (x^4 + 9)^{10}$

12. Differentiate:  $y = xe^{x^2}$

13. Differentiate:  $y = \frac{\sqrt{x} + 1}{e^{2x}}$

14.  $\int e^{-x/2} dx$

15.  $\int \left( \frac{5}{x} - \frac{x}{5} \right) dx$

16.  $\int \frac{x^3 - 2x^2 + 3x - 7}{x} dx$

17. Find the average value of the function:  $f(x) = xe^{x^2}$  ;  $[0,3]$

18.  $\int \frac{(1 + e^{-x})^3}{e^x} dx$

19.  $\int_0^{\ln 3} \frac{e^x + e^{-x}}{e^{2x}} dx$

20. Suppose that the marginal cost function of a handbag manufacturer is:

$C'(x) = \frac{3}{32}x^2 - x + 200$  dollars per unit. Find the total cost of bumping up production from 2 units to 6 units.

21. (a) How much do you have to invest at 6.5% interest compounded constantly to get \$41,787 in 22 yrs.?

(b) How fast is this investment growing when it reaches \$18,000?

22. 1000 H1N1 critters can triple in 30 minutes. How long will it be before there are 1 million of the beasts?

23. *Pennicillium aspergillus* can produce penicillin exponentially. 70 spores land on a piece of bread and start cranking out the antibiotic at a rate of 94% penicillin molecules per hour. The bread, however, has already been invaded by *Escherichia coli* bacteria, who have a sizeable colony of 700,000 critters and are reproducing exponentially at a rate of 14% per hour. How long will it be before the vastly outnumbered *Pennicillium* produce enough molecules of penicillin to wipe out the superior forces of the bacteria? (assume, unrealistically, that a single penicillin molecule will kill a single bacterium)

24. Supplement #5, Numbers 19 through 22 (multiple choice)