

Additional Practice Problems – Chapters 3 & 5

1. Sketch the graph of the following functions, using translations of a basic logarithm or exponential graph:

a. $f(x) = 1 - \ln(x - 3)$ b. $f(x) = 4e^{-x/2}$

2. Solve the equation $\ln x + \ln(x - 3) = 0$ for x .

3. Evaluate the expression $\cos(\arctan(x + 1))$ by making a sketch of a right triangle

4. Find the derivatives of the following functions:

a. $f(x) = x\sqrt{\ln x}$

b. $y = 3e^{-3/t}$

c. $g(x) = \frac{x^2}{e^x}$

d. $y = \sqrt{e^{2x} + e^{-2x}}$

e. $y = \sqrt[5]{\frac{4x^2 - 1}{x + 3}}$

f. $y = \frac{1}{2} \arctan e^{2x}$

g. $f(x) = \tan(\arcsin x)$

5. Find $(f^{-1})'(4)$ for $f(x) = x\sqrt{x - 3}$.

6. Evaluate the following indefinite integrals (Some of these use the technique of substitution).

a. $\int (3x^4 - 6x + 5) dx$

b. $\int 3\sqrt{x} dx$

c. $\int (3 \cos x - 4 \sin x) dx$

d. $\int 2 \sec x \tan x dx$

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

f. $\int 5 \sec^2 x dx$

g. $\int t^3(1 + t^4)^3 dt$

h. $\int \cos x \sqrt{\sin x + 1} dx$

i. $\int \frac{6x}{(x^2 - 3)^2} dx$

j. $\int \frac{1}{16 + x^2} dx$

k. $\int \frac{\sin x}{1 + \cos x} dx$

l. $\int \frac{e^{1/x}}{x^2} dx$

7. Find the function $f(x)$ that satisfies the conditions: $f'(x) = 3 \sin x + x$, $f(0) = 4$

8. Verify that the Riemann sum for $f(x) = 4 - x^2$ over the interval $[-1, 1]$ is

$$\sum_{i=1}^n \left(4 - \left(-1 + \frac{2i}{n} \right)^2 \right) \frac{2}{n}$$

9. The definite integral $\int_{-1}^1 4 - x^2 dx$ is defined to be $\lim_{n \rightarrow \infty} \sum_{i=1}^n \left(4 - \left(-1 + \frac{2i}{n} \right)^2 \right) \frac{2}{n}$.
- Simplify the sum $\sum_{i=1}^n \left(4 - \left(-1 + \frac{2i}{n} \right)^2 \right) \frac{2}{n}$. That is, rewrite it without the summation.
 - Take the limit as $n \rightarrow \infty$.
 - Check your answer using the Fundamental Theorem of Calculus.
10. Evaluate the following definite integrals, using the Fundamental Theorem of Calculus:
- $\int_1^2 \left(x\sqrt{x} + \frac{1}{\sqrt{x}} \right) dx$
 - $\int_1^{-1} (r+1)^2 dr$
 - $\int_0^1 \sqrt{t^5 + 2t} (5t^4 + 2) dt$
 - $\int_0^\pi x \sin(x^2) dx$
 - $\int_0^{\pi/8} \sec^2(2x) dx$
 - $\int_0^{1/2} \frac{2}{\sqrt{1-x^2}} dx$
11. If oil leaks from a tank at the rate of $r(t)$ gallons per minute at time t , what does $\int_0^{120} r(t) dt$ represent?
12. An animal population is increasing at the rate of $200 + 5t$ per year (where t is measured in years). By how much does the animal population increase between the fourth and tenth years?
13. A population of alligators is given by the function $P(t) = \sin t + 35$, for the time period $t = 0$ to $t = 5$ (t measured in years). What is the average population over this time period?

The problems on this page are intended to test your basic knowledge of how to calculate derivatives and integrals. There may be several more conceptual questions on the exam. Be sure to look over definitions and concepts and be able to “connect the dots.”

****You should also look at the suggested review problems listed on the review sheet. Look over homework questions and quiz questions.****