

1. (14 points) Find the functions $f(x)$ and $g(x)$ that fit the following data:

a.

x	1	2	3	4
f(x)	.375	.611	.996	1.624

b.

x	1	3	5	7
g(x)	2.09	1.15	.21	-.73

2. (11 points) Find the growth rate, continuous growth rate and the tripling time of a population given by

$$P(t) = 600(1.2)^t.$$

3. (11 points) How much money would you have after 15 years if you initially invest \$5,000 in a bank that has an annual interest rate of 12 percent and interest is compounded every three months? If, instead, interest is compounded continuously, how much money would you have?

4. (14 points)

a. Below is the graph of a function $f(x)$. In the same xy -plane, graph the function $f'(x)$.

b. Below is the graph of a function $f'(x)$. In the same xy -plane, graph the function $f(x)$ given that $f(0) = 2$.

5. (28 points) Find the derivative of each of the following functions:

a. $f(x) = x^3 + 3x\sqrt{x} - \frac{2}{x^4}$

b. $h(y) = \sqrt{y^2 + 1}$

c. $g(z) = \frac{\sin^2(z^3)}{z^2 + 16}$

d. $k(t) = (t^2 + 2t + 1)^{100} e^{5t}$

6. (10 points) Find an equation of the tangent line to the curve

$$x^5 + 3x^2y + y^3 = 2x + 13,$$

at the point (1,2).

7. (10 points) Use the definition of the derivative to find $f'(x)$ given that

$$f(x) = \frac{3}{x^2}.$$

No credit for any other method.

8. (10 points) One thousand feet of chain fence will be used to construct six cages of the same dimensions as shown in the figure. Find the dimensions of the cages that maximizes the total area of the six cages.

9. (14 points)

a. Find the average value of $f(x) = \cos(x^2)$ on the interval $[0, 2]$.

b. Find $f'(x)$ if $f(x) = \frac{2x+3}{x^2+4}$.

10. (10 points) Find the area between the curve $y = x(x - 3)(x - 4)$ and the x-axis between $x = 0$ and $x = 4$.

11. (10 points) draw a possible graph of a function $f(x)$ with the following properties:

$$f(0) = 1, \quad f'(0) = f'(3) = 0,$$

$$f'(x) > 0 \text{ on } (-\infty, 0),$$

$$f'(x) < 0 \text{ on } (0, 3) \text{ and on } (3, \infty),$$

$$f''(x) > 0 \text{ on } (1, 3),$$

$$f''(x) < 0 \text{ on } (-\infty, 1) \text{ and on } (3, \infty).$$

12. (10 points) A page of a book is to have an area on 90 in^2 with 1 in. margins at the bottom and sides and a $\frac{1}{2}$ in. margin at the top. Find the dimensions of the page that will allow the largest printed area.

13. (10 points) Draw a picture associated with the Right-Hand sum with $N = 4$ for the integral $\int_0^4 (16 - x^2) dx$. Without using the calculator and showing all work find the value of this Right-Hand sum with $N = 4$. Then using your calculator write down the value of the Right-Hand sum for $N = 12$. Finally using the fundamental theorem of calculus find the exact value of this integral.

14. (10 points) Find the effective interest rate if a bank has an annual interest rate of 6 percent and interest is compounded 12 times a year.

15. (10 points) Given the information below find and classify the critical points of $f(x)$

16. (18 points) Find a possible equation for each of the following: