

For problems 1, 2, and 3: Find equation of any vertical or horizontal asymptotes. If there are none, write 'none'.

1)  $y = \frac{-2x}{x^2 - 5x + 6}$

2)  $f(x) = \frac{3x^2 - 3x - 6}{2x^2 - 6x - 20}$

3)  $g(x) = \frac{2x^3 + 3x}{5x - 1}$

Solve each exponential equation.

4)  $3^{x+1} = \frac{1}{27}$

5)  $4^{2x+1} = 8^{x-3}$

6)  $27^x = 9^{x^2+x}$

Compound interest formulas:  $A = P\left(1 + \frac{r}{m}\right)^{mt}$      $A = Pe^{rt}$

- 7) Find the accumulated amount if \$5000 is invested at 6% annual interest compounded quarterly for 6 years.
- 8) How long would it take (to the nearest tenth of a year) for \$1000 to accumulate to \$1250 at 4% annual interest rate compounded continuously?
- 9) Write  $4^{0.5} = 2$  in logarithmic form.
- 10) Use your calculator to approximate  $\ln 35.6$  and  $e^{2.3}$ .
- 11) Use your calculator and the change of base formula to approximate  $\log_3 17$  to 4 decimal places.

Solve each equation. Round to 4 decimal places, if necessary.

12)  $\log_6(x+1) = 2$

13)  $\log(x+5) + \log(x+2) = 1$

14)  $3^{x+2} = 7^x$

15) Suppose  $\log_b 2 = x$  and  $\log_b 5 = y$ . Use the properties of logarithms to determine  $\log_b 20$ .

16) Evaluate  $\log_4 64$  and  $\log_3 \frac{1}{9}$  without a calculator.

- 17) Use the properties of logarithms to write the expression as a sum, difference, or product of simpler logarithms. Simplify where possible.

$$\log_4 \left( \frac{16p}{\sqrt{q}} \right)$$

- 18) Find each limit, if it exists. (a)  $\lim_{x \rightarrow \infty} \frac{3x^2 - 5}{2x - 5x^2}$  (b)  $\lim_{x \rightarrow -\infty} \frac{5x - 3}{2x^2 + 7x - 1}$

Find each derivative.

19)  $y = -14e^{2x}$  20)  $f(x) = -2x^2 e^{-3x}$

21)  $y = \frac{\ln(2x+6)}{x+3}, x > -3$  22)  $y = (x^3 + e^{2x})^3$

23)  $f(x) = \frac{e^x(x^2 + 2)}{\ln x}$

- 24) Find the slope of the tangent line and the equation of the tangent line to the curve  $y = xe^x$  at the point where  $x = 1$ .

- 25) Find any open intervals where these functions are increasing.

(a)  $f(x) = 4x^3 + 8x^2 - 16x + 11$  (b)  $g(x) = \frac{15}{2x+7}$

Find the locations and values of all relative maxima and minima.

26)  $f(x) = 2x^3 + 3x^2 - 12x + 5$  27)  $g(x) = \frac{\ln x}{2x^2}, x > 0$

Find the second derivative of each function.

28)  $f(x) = 9x^3 + \frac{2}{x}$  29)  $g(x) = \frac{1-2x}{4x+3}$

30) Find  $f''(2)$  and  $f''(5)$  if  $f(x) = 2x^2 - 5x^3 + \frac{1}{x^2}$

- 31) Find any intervals where the function  $f(x) = -x^3 - 12x^2 - 45x + 2$  is concave upward. Find any intervals where the function is concave downward.

- 32) Find any relative maximum or relative minimum point(s) and any point(s) of inflection for the graph of the function  $f(x) = -x(x-3)^2$ .

- 33) Suppose that the number of bacteria  $N$  (in millions) present in a certain culture at time  $t$  (in hours) is given by the function  $N(t) = t^3 - 18t^2 + 96t + 1000$ . In how many hours (before 8 hours) will the population of bacteria be maximized? Find that maximum population.
- 34) The percent of concentration of a drug in the bloodstream  $x$  hours after the drug is administered is given by  $K(x) = \frac{4x}{3x^2 + 27}$ . Find the time at which the concentration is a maximum and what the maximum concentration is.
- 35) If a cannonball is shot directly upward with a velocity of 256 feet per second, its height above the ground after  $t$  seconds is given by  $h(t) = 256t - 16t^2$ .
- Find the velocity of the cannonball after  $t$  seconds. After 2 seconds.
  - Find the acceleration after  $t$  seconds ( feet per second<sup>2</sup>).
  - What is the maximum height reached by the cannonball?
  - When will the cannonball hit the ground?
- 36) Make a hand-drawn sketch of the function  $f(x) = 2x^3 - 3x^2 - 12x + 1$ . Use the intervals of increasing or decreasing, intervals of concavity, intercepts (if possible), relative extrema, point(s) of inflection, etc.