

November 20, 1998

Your name \_\_\_\_\_

The first 13 problems count 6 points each and the final 2 count 20 points each.

1. Which of the equations below models the statement that  $Q$  varies inversely with  $1 + p$ ?

(A)  $Q = 1 + p$     (B)  $Q = k(1 + p)$     (C)  $Q = k \cdot (1 + p)^{-1}$

(D)  $Q = 1/(1 + p)$     (E)  $p = 1/Q$

2. Recall that the slope  $a$  of the regression line for a given set of data points is given by

$$a = \frac{n \sum_{i=1}^n x_i y_i - \sum_{i=1}^n x_i \sum_{i=1}^n y_i}{n \sum_{i=1}^n x_i^2 - (\sum_{i=1}^n x_i)^2}$$

What is the slope of the line which best fits the set  $\{(0, 0), (1, 1), (2, 0)\}$ .

(A) 0    (B) 1/2    (C) 1/3    (D) 1/4    (E) 1

3. The quantity  $V$  varies directly with quantity  $t$  and inversely with quantity  $P$ . When  $P = 2$  and  $t = 4$ ,  $V = 12$ . What is the value of  $V$  when  $t = 5$  and  $P = 3$ ?

(A) 8    (B) 10    (C) 12    (D) 15    (E) 20

4. The rational function  $f$  is defined by

$$f(x) = \frac{(2x - 4)(x^2 - 1)}{(x^2 - 4)(x - 3)}.$$

Which of the following lines is **not** an asymptote?

(A)  $y = 2$     (B)  $x = 3$     (C)  $x = -2$     (D)  $x = 2$

5. Which line are asymptotes of

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

Circle all that apply.

(A)  $y = 0$     (B)  $y = 1$     (C)  $x = 3$     (D)  $x = -2$     (E)  $x = 2$

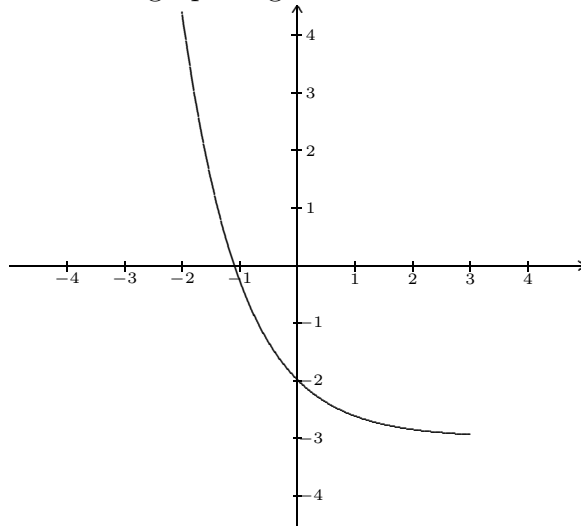
6. When  $\frac{(2x+2)(x-1)^2}{(x-3)(x+4)}$  is expressed in rational function form

$$\frac{a_n x^n + a_{n-1} x^{n-1} + \dots + a_0}{b_m x^m + b_{m-1} x^{m-1} + \dots + b_0},$$

what is the value of  $\frac{a_n}{b_m} + a_0 + b_1$ ?

- (A) 1    (B) 5    (C) 9    (D) 11    (E) 12
7. Which of the following equations is equivalent to  $8^{-3} = 1/512$ ?
- (A)  $\log_3 \frac{1}{512} = -8$     (B)  $\log_8 \frac{1}{512} = -3$     (C)  $\log_8 512 = -3$   
(D)  $\log_{512} 3 = -8$     (E)  $\log_3 512 = 8$
8. Given that  $\log_b 3 = 5.3069$  and  $\log_b 5 = 7.7745$ , what is  $\log_b \sqrt[3]{45}$ ?
- (A) 1.230    (B) 2.369    (C) 4.360    (D) 6.129    (E) 7.234
9. Which of the following points belong to the domain of the function  $y = \ln(|x-3| - 1)$ ? Circle all those that apply.
- (A) 0.5    (B) 1.5    (C) 2.5    (D) 3.5    (E) 6.5
10. Which of the statements below are correct? Circle all that apply.
- (A)  $(\ln x)(\ln y) = \ln(x+y)$     (B)  $\log_2(u/v) = \log_2 u - \log_2 v$     (C)  $e^x + e^y = e^{xy}$   
(D)  $e^x + e^y = e^{x+y}$     (E)  $e^{xy} = (e^x)^y$
11. Solve for  $x$ :  $3^{2-x} = 81$ .
- (A) -2    (B) -1    (C) 0    (D) 3    (E) 4

12. Identify the function whose graph is given below.



- (A)  $y = e^x - 3$     (B)  $y = -e^x - 3$     (C)  $y = e^{-x} - 3$   
(D)  $y = 3 - e^x$     (E)  $y = e^{3x}$

13. How much more is it worth to invest \$1000 at 12% compounded monthly for one year than to invest \$1000 at 12% compounded quarterly for one year?

- (A) \$1.31    (B) \$1.37    (C) \$1.43    (D) \$13.30    (E) \$13.73

On all the following questions, **show your work**.

14. Suppose that \$400 is deposited into an account with an annual percentage rate of 8%.

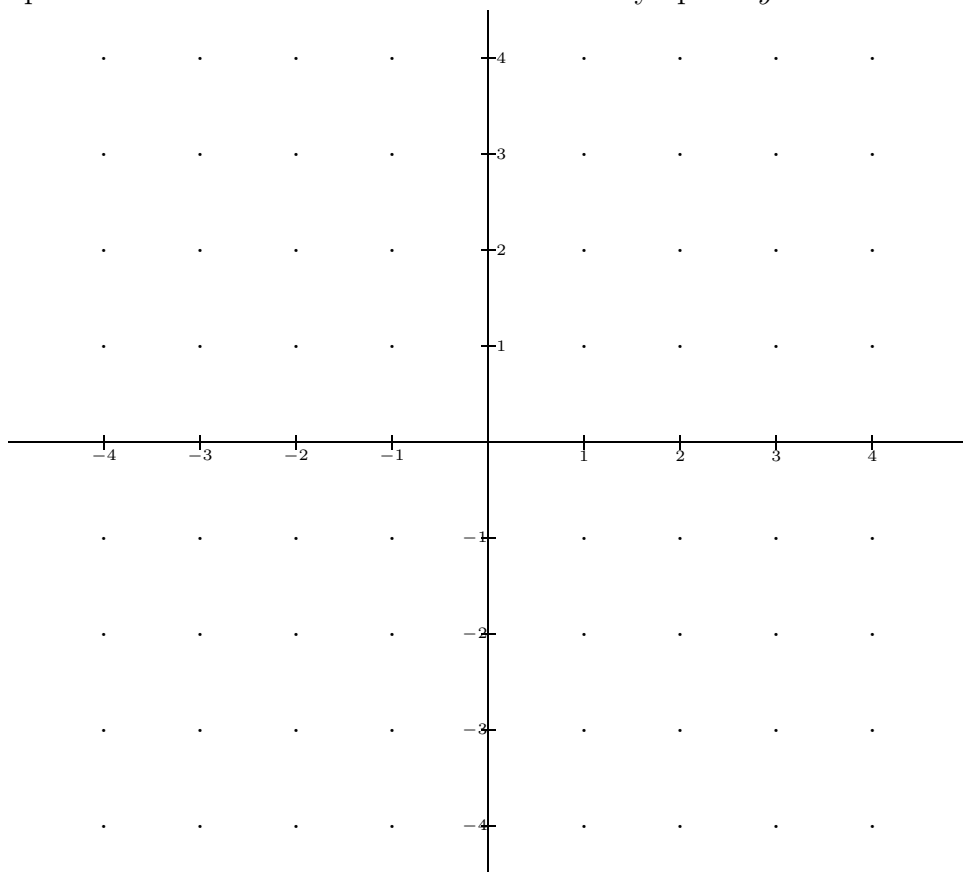
(a) What is the balance in the account after 3 years, assuming that compounding takes place quarterly? Round your answer to the nearest penny.

(b) How many years (to the nearest hundredth of a year) does it take the account to double, again compounding quarterly?

(c) How many years (to the nearest hundredth of a year) does it take the account to double, this time compounding continuously?

15. Asymptotes and graphs.

- (a) Sketch a graph on the grid provided below of a function which satisfies the following. It has zeros at  $x = 0$  and  $x = 2$ , vertical asymptotes  $x = -2$  and  $x = 3$  and a horizontal asymptote  $y = -1$ .



- (b) Find a symbolic representation of such a function.