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

\[
\frac{a_n x^n + a_{n-1} x^{n-1} + \ldots + a_0}{b_m x^m + b_{m-1} x^{m-1} + \ldots + b_0},
\]

what is the value of \( \frac{an}{bm} + a_0 + b_1 \)?

(A) 1  (B) 5  (C) 9  (D) 11  (E) 12

7. Which of the following equations is equivalent to \( 8^{-3} = \frac{1}{512} \)?

(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 \( \log_b \sqrt{45} \)?

(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.

\[ y = e^x - 3 \]  

(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?

\[ (A) \$1.31 \quad (B) \$1.37 \quad (C) \$1.43 \quad (D) \$13.30 \quad (E) \$13.73 \]
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.