

- What is the range of the function defined by the equation  $y = -x^2 + 6x + 3$ ?  
(a)  $(-\infty, 3]$  (b)  $(-\infty, 6]$  (c)  $(-\infty, 9]$  (d)  $(-\infty, 12]$  (e)  $(-\infty, 15]$  (f)  $(-\infty, 18]$
- If  $b$  and  $c$  are real numbers so that the polynomial  $x^2 + bx + c$  has  $3 + 2i$  as a zero, find  $b + c$ .  
(a) 5 (b) 6 (c) 7 (d) 8 (e) 9 (f) 10
- Let  $R(x) = \frac{3x^2 + 5x + 1}{x + 2}$ . Then  $R(x)$  has an oblique asymptote at:  
(a)  $y = 3x - 1$  (b)  $y = 3x + 1$  (c)  $y = -3x - 1$  (d)  $y = -3x + 1$  (e)  $y = 3x$  (f)  $y = -3x$
- Solve the inequality:  $\frac{x(x^2 + 2x + 1)}{x^2 - 4x + 4} \leq 0$   
(a)  $(-\infty, 0]$   
(b)  $[-1, 2)$   
(c)  $[-1, 0] \cup (2, \infty)$   
(d)  $(-\infty, -1] \cup \{0\} \cup (2, \infty)$   
(e)  $\{-1, 0\}$   
(f) All real numbers.
- Solve the inequality:  $\frac{5x + 1}{x} \geq 6$ .  
(a)  $(-\infty, 1]$  (b)  $(-\infty, 1)$  (c)  $(-1, 0)$  (d)  $[-1, 0)$  (e)  $(0, 1]$  (f)  $(0, 1)$
- Find  $k$  so that  $(x + 3)$  is a factor of  $x^{100} - 9x^{98} + kx^2 - 5x + 3$ .  
(a)  $k = -3$  (b)  $k = -2$  (c)  $k = -1$  (d)  $k = 1$  (e)  $k = 2$  (f)  $k = 3$
- Using the fact that  $-2$  and  $\frac{1}{3}$  are zeros of the polynomial,  $f(x) = 3x^4 + 5x^3 + x^2 + 5x - 2$ , find the sum of the other two zeros.  
(a)  $-2$  (b)  $-1$  (c)  $0$  (d)  $1$  (e)  $2$  (f)  $3$

8. Given  $x = i$  is a solution to  $x^4 - x^3 - x - 1 = 0$ . The real solutions to this equation are  $x = \frac{1 \pm \sqrt{b}}{2}$  where  $b =$

- (a) 0            (b) 1            (c) 2            (d) 3            (e) 4            (f) 5

9. Find the domain of the function  $f(x) = \ln \sqrt{\frac{1-x}{1+x}}$ .

- (a)  $(-1, 1)$     (b)  $(0, \infty)$     (c)  $x \neq -1$     (d)  $x \neq 1$     (e)  $y \neq \pm 1$     (f)  $x \neq 0$

10. If the number  $y$  is in the range of  $f(x) = \frac{2x+3}{x+2}$ , then which of the following must be true?

- (a)  $y \neq -2$     (b)  $y \neq -1$     (c)  $y \neq 0$     (d)  $y \neq 1$     (e)  $y \neq 2$     (f)  $y \neq 3$

11. If  $9^{1-x} = 27^x$ , then  $x =$

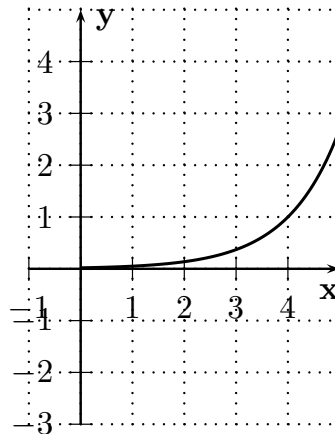
- (a)  $\frac{1}{4}$             (b)  $\frac{2}{7}$             (c)  $\frac{1}{2}$             (d)  $\frac{2}{3}$             (e)  $\frac{2}{5}$             (f) 1

12. Find  $\log_3(27\sqrt{3})$ .

- (a)  $1/2$             (b)  $3/2$             (c)  $5/2$             (d)  $7/2$             (e)  $9/2$             (f)  $11/2$

13. Select the function that best describes the given graph.

- (a)  $f(x) = \frac{e^x}{4}$   
 (b)  $f(x) = e^{x+4}$   
 (c)  $f(x) = e^{x-4}$   
 (d)  $f(x) = \frac{x^3}{4^3}$   
 (e)  $f(x) = \frac{\ln(x+1)}{10}$



14.  $\log_5 24$  is between

- (a) 0 and 1      (b) 1 and 2      (c) 2 and 3      (d) 3 and 4      (e) 4 and 5

15. Use properties of logarithms to find the exact value of the expression

$$\log_2 9 \cdot \log_3 4 \cdot \log_5 7 \cdot \log_7 25$$

- (a) 1      (b) 2      (c) 4      (d) 8      (e) 16      (f) 32

16. If  $\log_a x = 2$ ,  $\log_a y = 4$ , and  $\log_a z = 5$ , find the value of  $\log_a \left( \frac{a^2 x^3 z}{\sqrt{y^5}} \right)$ .

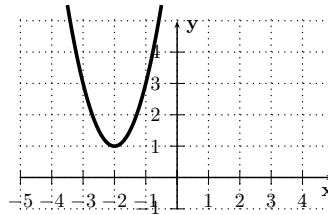
- (a) -2      (b) -1      (c) 0      (d) 1      (e) 2      (f) 3

17. How many years would it take an amount of money to double if it is invested at 50% compounded continuously?

- (a)  $\ln 2$       (b)  $2 \ln 2$       (c)  $3 \ln 2$       (d)  $4 \ln 2$       (e)  $5 \ln 2$       (f)  $\frac{\ln 3}{5}$

18. Write an equation for the parabola.

- (a)  $y = x^2 - 4x + 9$   
(b)  $y = x^2 + 4x + 9$   
(c)  $y = x^2 - 8x + 9$   
(d)  $y = 2x^2 + 8x + 9$   
(e)  $y = 2x^2 - 8x + 9$   
(f)  $y = 2x^2 + 6x + 9$



19. Which of the following conics is represented by the equation  $x^2 + y^2 + 4x - 2y = 3x^2$ ?

- (a) Circle      (b) Ellipse      (c) Parablola      (d) Hyperbola      (e) None of these

20. Find the foci of the ellipse  $\frac{(x+1)^2}{25} - \frac{(y-2)^2}{9} = 1$ .

- (a) (1,-1) and (1,5)      (b) (-1,-2) and (-1,8)      (c) (-4,2) and (2,2)      (d) (-4,-2) and (2,-2)      (e) (3,2) and (-5,2)

21. Solve the system of equations for  $y$ .

$$\begin{aligned} x + y - z &= 0 \\ x - y + z &= 2 \\ x + y + z &= 6 \end{aligned}$$

- (a)  $y = 1$       (b)  $y = 2$       (c)  $y = 3$       (d)  $y = 4$       (e)  $y = 5$

22. If  $\frac{x+3}{x^2+3x+2} = \frac{A}{x+1} + \frac{B}{x+2}$ , then  
(a)  $A+B=0$     (b)  $A+B=1$     (c)  $A+B=2$     (d)  $A+B=3$     (e)  $A+B=4$
23. Find the infinite geometric sum  $3 + \frac{3}{2} + \frac{3}{4} + \frac{3}{8} + \dots$ .  
(a) 1    (b)  $\frac{3}{2}$     (c) 2    (d) 4    (e) 6
24. Write  $2.\overline{27}$  as a fraction in simplest form.  
(a)  $\frac{2123}{999}$     (b)  $\frac{2120}{999}$     (c)  $\frac{707}{333}$     (d)  $\frac{212}{99}$     (e)  $\frac{25}{11}$
25. Find the constant term in the expansion of  $\left(x^2 - \frac{1}{x}\right)^6$ .  
(a) 6    (b) -6    (c) 15    (d) -15    (e) 20    (f) -20
26. Find the coefficient of  $x^2$  in  $(x-1)^{100}$ .  
(a) 1    (b) -1    (c) 100    (d) -100    (e) 4950    (f) -4950
27. How many ways can you arrange the letters in the word *PARALLEL*?  
(a) 3360    (b) 420    (c) 180    (d) 90    (e) 45
28. How many different 3-letter passwords can be made from the word *POINT* if a letter can appear just once in a password?  
(a) 10    (b) 20    (c) 30    (d) 40    (e) 60
29. Determine the probability of getting four or less when rolling a pair of dice.  
(a)  $\frac{1}{9}$     (b)  $\frac{1}{6}$     (c)  $\frac{1}{4}$     (d)  $\frac{1}{3}$     (e)  $\frac{2}{9}$
30. Five people randomly choose integers between 1 and 5 inclusive. What is the probability that at least two of them choose the same number?  
(a)  $\frac{24}{625}$     (b)  $\frac{601}{625}$     (c)  $\frac{7}{8}$     (d)  $\frac{4}{5}$     (e)  $\frac{9}{10}$

1. d
2. c
3. a
4. a
5. e
6. b
7. c
8. f
9. a
10. e
11. e
12. d
13. c
14. b
15. d
16. f
17. b
18. d
19. d
20. e
21. b
22. b
23. e
24. e
25. c
26. e
27. a
28. e
29. b
30. b