

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. The quadratic equation  $x^2 + x + 3 = 0$  has:
- A. two distinct real roots  
 B. one real root and one complex root  
 C. no real root  
 D. equal roots  
 E. none of these
2. If  $t \neq 2$  or  $-2$ , the solution set for the equation  $\frac{2t}{t+2} - 2 = \frac{t-8}{t-2}$  is:
- A. {6}                      B. {4, -6}  
 C. {6, -4}                D. {-12}  
 E. none of these
3. Solve:  $n + 2(n + 4) = 1 + 3(n + 2)$
- A. 7                              B.  $\emptyset$   
 C. 8                              D. all real numbers  
 E. none of these
4. Solve:  $3x^2 + 6x = 10$
- A.  $\frac{-1 \pm \sqrt{39}}{3}$                 B.  $\frac{-1 \pm \sqrt{19}}{3}$   
 C.  $\frac{-3 \pm \sqrt{39}}{3}$                 D.  $\frac{-3 \pm 2\sqrt{19}}{3}$   
 E. none of these
5. Solve  $\frac{k}{k+2} = 8 - \frac{2}{k+2}$  for  $k$ .
- A. -2      B. 2      C. 6      D.  $\emptyset$   
 E. none of these
6. Solve:  $x^4 - 6x^2 + 8 = 0$
- A.  $\sqrt{2}$ ,  $-\sqrt{2}$ , 2 and -2  
 B. 2 and 4  
 C. 2 and -2  
 D. 2, -2,  $2i$  and  $-2i$   
 E. no solution
7. Find the quadratic equation with the solution set  $\{-\frac{3}{5}, \frac{1}{10}\}$ .
- A.  $x^2 + 25x - 3 = 0$       B.  $50x^2 + x - 3 = 0$   
 C.  $50x^2 + 25x - 3 = 0$     D.  $5x^2 + 25x - 3 = 0$   
 E. none of these
8. Which of the following are solutions of the equation  $\sqrt{2x-3} = x-3$ ?
- A. 0                              B. 2  
 C. 6                              D. both a and c  
 E. both b and c

9. In your search for a summer job, you are given the following offers.

Offer 1: At Timmy's Tacos you will earn \$4.50 an hour. However, you will be required to purchase a uniform for \$45.00. You will be expected to work 20 hours each week.

Offer 2: At Kelly's Car Wash you will earn \$3.50 an hour. No special attire is required. You must agree to work 20 hours each week.

Before deciding which job offer you wish to take, you consider many factors. Which conclusion below is not true?

- A. If I work 8 weeks at Kelly's Car Wash and save all my earnings, I'll be able to save \$560.
- B. If I take the job at Timmy's Tacos, I'll have to work 10 hours just to pay for purchasing my uniform.
- C. If I only plan to work for two weeks, I should choose the job at Kelly's Car Wash.
- D. If I plan to work for at least 3 weeks, I should choose the job at Timmy's Tacos.
- E. The job at Timmy's Tacos pays more if I work more than forty hours.

10. If  $x^2 + y^2 = 25$  and  $x^2 - y^2 = 7$  then  $x^4 - y^4$  equals?

- A. 7    B. 14    C. 49    D. 175    E. 337

11. Consider the following quadratic equations:

I)  $x^2 + 1 = 0$

II)  $x^2 - 2 = 0$

III)  $x^2 + x - 1 = 0$

IV)  $x^2 - x - 2 = 0$

Which of these equations, if any, has two different real number solutions?

- A. II, III, and IV only    B. II and IV only
- C. I, II, and III only    D. I, II, III, IV
- E. none of these

12. Given that 11 is the maximum value of the function  $f(x) = -x^2 + 6x + c$  find the value for "c".

- A. 0    B. 1    C. 11    D.  $\frac{11}{6}$     E. 2

13. A polynomial,  $P(x)$ , has real coefficients and also has zeros at 1,  $1 + i$ , and  $2 - i$ . Then this polynomial must have a degree of:

- A. at least 5    B. exactly 6
- C. exactly 3    D. at least 6
- E. none of these

14. Find all the roots (integral, rational, and/or complex) of the polynomial:

$$x^4 + x^3 - 16x^2 - 4x + 48$$

- A. (2, -2, -4, 3)    B. (2, -2, i, 3)
- C. (2, -4, 3, 5)    D. (2, -2, -i, 3)
- E. none of these

15. Using complex numbers, factor  $a^4 - b^4$  completely as:

- A.  $(a^2 - b^2)(a^2 + b^2)$
- B.  $(a - b)(a^3 + b^3)$
- C.  $(a - b)(a - b)(a + b)(a + b)$
- D.  $(a - b)(a + b)(a - bi)(a + bi)$
- E. none of these

16. The product  $(6 + 3i) \cdot (5 - i)$  in complex numbers is:

- A.  $30 + 9i + 6i^2$
- B.  $24 + 9i$
- C.  $33 + 9i$
- D.  $11 + 2i$
- E. none of these

17. To solve  $4z^2 - 8z = -5$  in the complex number system by completing the square, what numerical expression should be added to each side?

- A. +16
- B. +1
- C. -16
- D. -1
- E. none of these

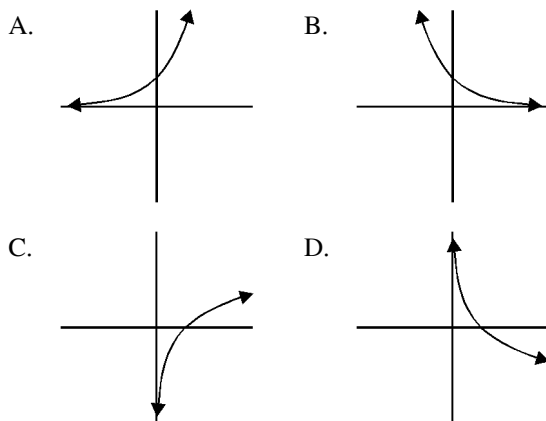
18. Find  $x$  such that  $125^{x-1} = 25$ .

- A.  $x = \frac{3}{2}$
- B.  $x = \frac{1}{3}$
- C.  $x = \frac{5}{3}$
- D.  $x = 1$
- E. none of these

19. Find  $y$  so that  $\log_4 8 = y$ .

- A. 3
- B.  $\frac{2}{3}$
- C.  $\frac{3}{2}$
- D.  $\frac{1}{2}$
- E. none of these

20. Which of the following graphs best represents the shape of the graph  $y = e^x$ ?



E. none of these

21. An exponential function  $f$  has the general equation

$$f(x) = ab^x$$

where  $a$  and  $b$  represent constants. If the ordered pairs  $(5, 100)$  and  $(11, 4321)$  are solutions of the function, then the constant  $b$  is closest to the value:

- A. 1.84
- B. 1.85
- C. 1.86
- D. 1.87
- E. 1.88

22. Dovetail Carpentry Shop makes bookcases and desks. Each bookcase requires 5 hours of woodworking and 4 hours of finishing. Each desk requires 10 hours of woodworking and 3 hours of finishing. Each month the shop has 600 hours of labor available for woodworking and 240 hours for finishing. The profit on each bookcase is \$40 and on each desk is \$75. How many of each product should be made in order to maximize profit?

- A. 48 bookcases, 24 desks.
- B. 60 bookcases, 0 desks.
- C. 57 bookcases, 4 desks.
- D. 12 bookcases, 54 desks.
- E. None of these.

23. In a class with 14 women and 7 men, 2 students are chosen at random. If all have an equal chance of being picked, what is the chance of getting a pair (1 men and 1 women)?

- A.  $\frac{1}{2}$     B.  $\frac{7}{30}$     C.  $\frac{7}{30}$     D.  $\frac{2}{9}$     E.  $\frac{4}{9}$

24. Sue ate 100 pizzas in 5 days, each day eating 6 more than on the previous day. How many pizzas did she eat on the fourth day?

- A. 18    B. 26    C. 30    D. 32
- E. none of these

25. In a geometric sequence of real numbers, the sum of the first two terms is 7, and the sum of the first 6 terms is 217. The sum of the first four terms is:

- A. 28    B. 35    C. 84    D. 112    E. 42

26. Find the twentieth term of 6, 3, 0, ...

- A. -48    B. -51    C. -54    D. -57
- E. none of these

27. Simplify:  $\left(\frac{a+b}{a-b}\right)^{-1} \div \frac{a^2+b^2}{a^2+2ab+b^2}$

- A.  $\frac{(a-b)}{(a+b)^2}$     B.  $\frac{(a-b)}{(a+b)}$
- C.  $\frac{(a^2+b^2)}{(a^2-b^2)}$     D.  $\frac{(a^2-b^2)}{(a^2+b^2)}$
- E. none of these

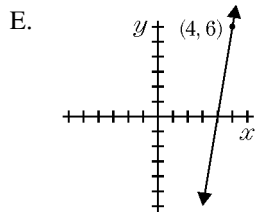
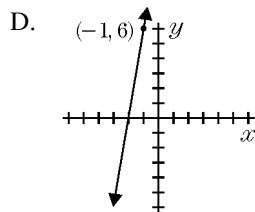
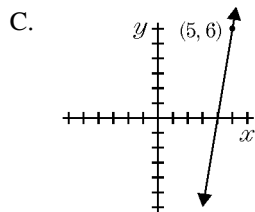
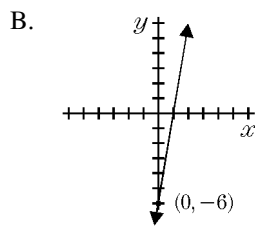
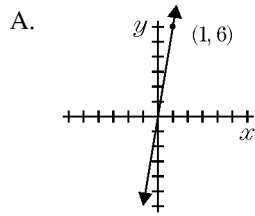
28. Simplify:  $\frac{x+3}{x^2-1} - \frac{x-2}{x^2+2x+1}$

- A.  $\frac{7x+1}{(x-1)(x+1)^2}$     B.  $\frac{x+5}{(x-1)^2(x+1)}$
- C.  $\frac{2x^2+x+5}{(x-1)(x+1)^2}$     D.  $\frac{-1}{(x-1)^2(x+1)}$
- E. none of these

29. Find the inverse of the function  $f(x) = x^3 + 1$ .

- A.  $x^{1/3} + 1$     B.  $(x-1)^{1/3}$
- C.  $\pm(x-1)^{1/3}$     D.  $x^{1/3} + 1$
- E. no inverse exists

30. If  $f(x) = 2x - 4$  which of the following is the graph of  $3f(x + 2)$ ?



31. Which of the following must be true for the function  $f(x) = x|x|$ ?

- I. The function is odd.
- II. The graph of the function is symmetric with respect to the origin.
- III. The function is neither even nor odd.

- A. I only
- B. II only
- C. III only
- D. I and II only
- E. II and III only

32. An experiment was conducted in an algebra class. Forty dice were placed in a cup. After shaking the cup, the dice were rolled on the floor and all the fours were removed. The remaining dice were returned to the cup and the process was repeated until only one die remained. The students used the data to write a function where  $x$  represented the roll numbers,  $0, 1, 2 \dots$  and  $f(x)$  represented the number of dice remaining. Which function below is the most realistic for modeling the data found?

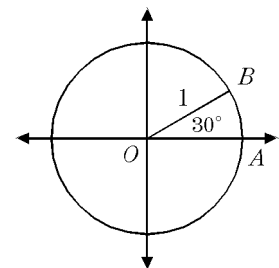
- A.  $f(x) = -3x + 35$
- B.  $f(x) = -2.9x + 40$
- C.  $f(x) = 14x^2 - 4.5x + 37$
- D.  $f(x) = 39(0.85)^x$
- E.  $f(x) = 40(1.16)^x$

33. The scores of an exam have a normal distribution. The mean of the scores is 48 and the standard deviation is 5. Approximately what percent of the students taking the exam can be expected to score between 43 and 53?

- A. 95%
- B. 68%
- C. 34%
- D. 13%

34. In the accompanying diagram, the center of circle  $O$  is at the origin, radius  $OB = 1$ , and  $m\angle AOB = 30^\circ$ . What are the coordinates of point  $B$ ?

- A.  $(\frac{1}{2}, \frac{\sqrt{3}}{2})$
- B.  $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
- C.  $(\frac{\sqrt{3}}{2}, \frac{1}{2})$
- D.  $(1, 1)$



35. What is  $235^\circ$ , expressed in radian measure?

- A.  $235\pi$     B.  $\frac{\pi}{235}$     C.  $\frac{36\pi}{47}$     D.  $\frac{47\pi}{36}$

36. What is the amplitude of the graph of the equation  $y = 2 \sin \frac{1}{2}x$ ?

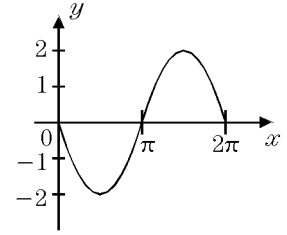
- A.  $\frac{1}{2}$     B. 2    C.  $\pi$     D.  $2\pi$

37. What is the period of the graph for the equation  $y = \cos 2x$ ?

- A.  $\pi$     B. 2    C. 3    D.  $4\pi$

38. Which is an equation of the graph shown?

- A.  $y = \sin 2x$   
B.  $y = -\sin 2x$   
C.  $y = -2 \sin x$   
D.  $y = 2 \sin x$



39. The expression  $\cos y(\csc y - \sec y)$  is equivalent to

- A.  $\cot y - 1$                       B.  $\tan y - 1$   
C.  $1 - \tan y$                       D.  $-\cos y$

40. What is the turning point of the parabola whose equation is  $y = 2x^2 + 4x - 3$ ?

- A. (1, 3)                              B. (-2, -3)  
C. (2, 13)                             D. (-1, -5)

- |         |   |         |   |
|---------|---|---------|---|
| 1.      |   | 20.     |   |
| Answer: | C | Answer: | A |
| 2.      |   | 21.     |   |
| Answer: | C | Answer: | D |
| 3.      |   | 22.     |   |
| Answer: | B | Answer: | E |
| 4.      |   | 23.     |   |
| Answer: | C | Answer: | C |
| 5.      |   | 24.     |   |
| Answer: | D | Answer: | B |
| 6.      |   | 25.     |   |
| Answer: | A | Answer: | E |
| 7.      |   | 26.     |   |
| Answer: | C | Answer: | B |
| 8.      |   | 27.     |   |
| Answer: | C | Answer: | D |
| 9.      |   | 28.     |   |
| Answer: | E | Answer: | E |
| 10.     |   | 29.     |   |
| Answer: | D | Answer: | B |
| 11.     |   | 30.     |   |
| Answer: | A | Answer: | A |
| 12.     |   | 31.     |   |
| Answer: | E | Answer: | D |
| 13.     |   | 32.     |   |
| Answer: | A | Answer: | D |
| 14.     |   | 33.     |   |
| Answer: | A | Answer: | B |
| 15.     |   | 34.     |   |
| Answer: | D | Answer: | C |
| 16.     |   | 35.     |   |
| Answer: | C | Answer: | D |
| 17.     |   | 36.     |   |
| Answer: | E | Answer: | B |
| 18.     |   | 37.     |   |
| Answer: | C | Answer: | A |
| 19.     |   | 38.     |   |
| Answer: | C | Answer: | C |
|         |   | 39.     |   |
|         |   | Answer: | A |
|         |   | 40.     |   |
|         |   | Answer: | D |