ALGEBRAIC EQUATIONS & INEQUALITIES
Pitt State Math Relays 2019

For each question below, completely shade in the shape next to the letter of the **simplest** correct answer in the appropriate space on the answer sheet. Only the answer sheet will be graded. NO CALCULATORS.

1. $6\left(-6x+6+4(x+1)\right)=6x+2$

    (A) $-\dfrac{7}{3}$ (B) $\dfrac{29}{9}$ (C) $-\dfrac{7}{3}$ (D) -2 (E) none of these

2. $\dfrac{18}{x-6}+2=\dfrac{6}{x-6}$

    (A) 0 (B) $2,\ -\dfrac{1}{2}$ (C) 6 (D) -18 (E) none of these

3. $x^2-14x\geq15$

    (A) $x\leq-3$ or $x\geq5$ (B) $-1\leq x\leq15$ (C) $x\leq-1$ or $x\geq15$ (D) $-3\leq x\leq5$ (E) none of these

4. $2(x-6)^2-10=0$

    (A) $1,11$ (B) $-1,-11$ (C) $6\pm\sqrt{5}$ (D) $-6\pm\sqrt{5}$ (E) none of these

5. $9^{x+6}=27^{x-5}$

    (A) 27 (B) 21 (C) 17 (D) 11 (E) none of these

6. $|x+2|+6\leq11$

    (A) $x<3$ (B) $-7\leq x\leq0$ (C) $-7\leq x\leq3$ (D) all real numbers   (E) none of these

7. If $f(x)=x^2-cx-2$ and $f(-2)=8$, then $c=$

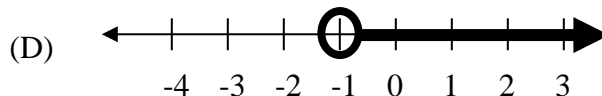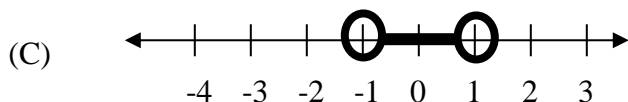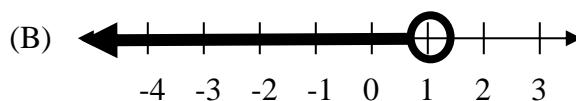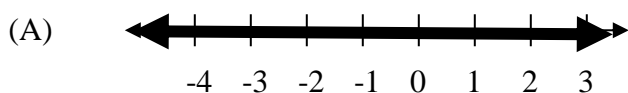   (A) -3 (B) 8 (C) -5 (D) 3 (E) none of these

8. Find the value of y in the solution. $\begin{cases}4x-3y=27\\5x-2y=39\end{cases}$

    (A) $\dfrac{7}{3}$ (B) 3 (C) -9 (D) 9 (E) none of these
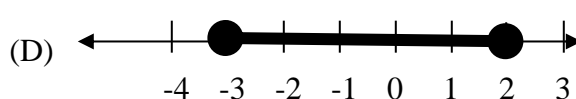
9. $\sqrt{x+6}+\sqrt{2-x}=4$
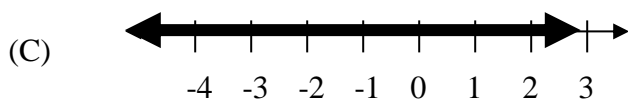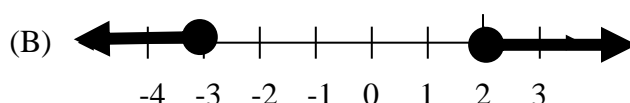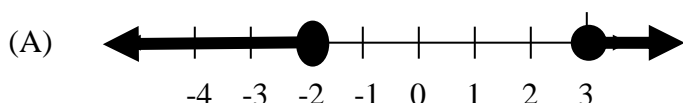
    (A) -2 (B) $\sqrt{31},-2$ (C) $2,-2$ (D) no solution   (E) none of these

10. The graph of the solution set for $4x + 5 > 1$ is

(A)

-4 -3 -2 -1 0 1 2 3

(B)

-4 -3 -2 -1 0 1 2 3

(C)

-4 -3 -2 -1 0 1 2 3

(D)

-4 -3 -2 -1 0 1 2 3

(E)   none of these

11. The graph of the solution set for $x^2 + x \geq 6$ is

(A)

-4 -3 -2 -1 0 1 2 3

(B)

-4 -3 -2 -1 0 1 2 3

(C)

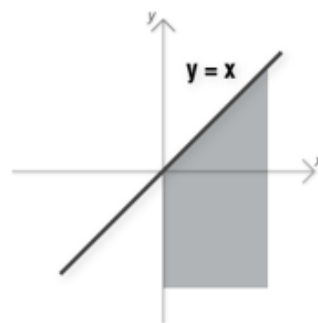-4 -3 -2 -1 0 1 2 3

(D)

-4 -3 -2 -1 0 1 2 3

(E) none of these

12. Which of the inequalities best describes the shaded region in the figure.

(A) $x \geq y$ and $x \leq 0$ (B) $x \geq y$ and $x \geq 0$ (C) $x \leq y$ and $x \geq 0$

(D) $x \leq y$ and $x \leq 0$ (E) none of these

13. The equality $6^4 = 1296$ can be written as

(A) $\log_6 4 = 1296$ (B) $\log_4 1296 = 6$ (C) $\log_6 1296 = 4$ (D) $\log_4 6 = 1296$ (E) none of these

14. The equation of the line through $(2, -3)$ and $(-3, 12)$ is

(A) $y = -15x + 27$ (B) $x = -3$ (C) $y = -15x - 1$ (D) $y = -9x + 15$ (E) none of these

15. The equation for the set of all points in the plane 4 units from the x-axis is

(A) $x^2 + y^2 = 16$ (B) $xy = 4$ (C) $y = 4$ (D) $|y| = 4$ (E) none of these

16. One of the solutions of $x^2 + 4x = -20$ is

(A) $4i$ (B) - 20   (C) $-2 + 4i$ (D) 2   (E) none of these

17. $\log_{10} x = 5$

(A) $\dfrac{5}{10}$ (B) 10,000   (C) $\dfrac{1}{100,000}$ (D) 100,000   (E) none of these

18. Solve for x. $8^{2x-3} = 16^{1-x}$

(A) $\dfrac{13}{10}$ (B) $\dfrac{1}{3}$ (C) -1 (D) $\dfrac{10}{7}$ (E) none of these

19. $|x+3|-2 \le 1$

    (A) $x < 6$ (B) $-6 \le x \le 0$ (C) $-6 \le x \le 2$ (D) $x \le 2$ (E) none of these

20. $x^2 - 14x \le 15$

    (A) $x \le -3$ or $x \ge 5$ (B) $-1 \le x \le 15$ (C) $x \le -1$ or $x \ge 15$ (D) $-3 \le x \le 5$

    (E) none of these

21. $9^x = 10$

    (A) $\dfrac{10}{9}$ (B) no solution   (C) $\log_{10}\left(\dfrac{10}{9}\right)$ (D) $\log_9 10$ (E) none of these

22. $t^{-2} - 1 = 8$

    (A) -3 (B) 3 (C) $\pm\dfrac{1}{3}$ (D) $\dfrac{1}{3}$ (E) none of these

23. $\dfrac{(2x-1)(x+4)}{x-3} = 0$

    (A) $4, -3$ or $-\dfrac{1}{2}$ (B) 4 or $-\dfrac{1}{2}$ (C) $-4, 3$ or $\dfrac{1}{2}$ (D) -4 or $\dfrac{1}{2}$ (E) none of these

24. $x^2 - 3 \ge -2x$

    (A) $-1 \le x \le 3$ (B) $x \le -3$ or $x \ge 1$ (C) $x \le -1$ or $x \ge 3$ (D) $-3 \le x \le 1$

    (E) none of these

25. $\log_2 x - \log_2 4 = 3$

    (A) $\dfrac{-7}{2}$ (B) 7 (C) $\sqrt{\dfrac{3}{4}}$ (D) 32 (E) none of these

26. The length L, in meters, of a spring is given by the equation $L = \dfrac{2}{3}F + 0.03$, where F is the applied force in newtons. What force, in newtons, must be applied for the spring's length to be 0.21 meters?

    (A) 0.13   (B) 0.225   (C) 0.255   (D) 0.27   (E) none of these

27. The equation $x^2 - 3x = 2$ has

(A) two distinct real solutions   (B) one real solution   (C) one real solution and one imaginary
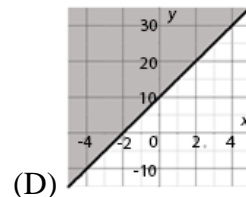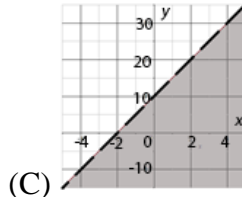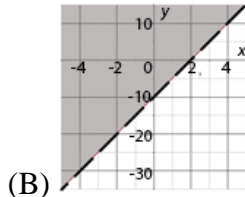
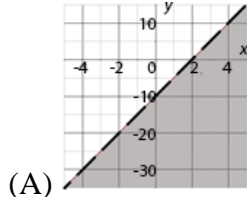solution   (D) no real solutions   (E) none of these

28. Solve $D = 2BC + 2AB + 2AC$ for A .

    (A) $\dfrac{D}{A} - \dfrac{2BC}{A} - 2B + 2C$ (B) $\dfrac{D - 2BC}{2B + 2C}$ (C) $\dfrac{2BC - D}{2BC}$ (D) $\dfrac{D - 4BC}{2C}$ (E) none of these

29. Find all roots of $x^4 - 9x^2 + 20 = 0$.

(A) 5, 4   (B) $\pm 5, \pm 4$ (C) $\pm\sqrt{5}, \pm 2$ (D) $\sqrt{5}+2i, \sqrt{5}-2i, 2+i\sqrt{5}, 2-i\sqrt{5}$ (E) none of these
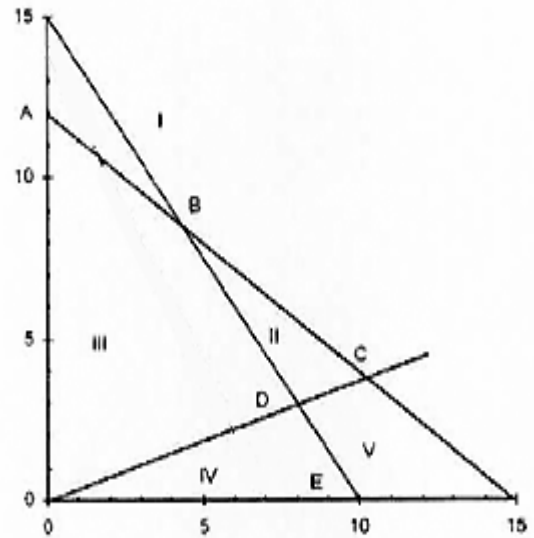
30. The graph of $5x - y > 10$ is

(A)   (B)   (C)   (D)   (E) none of these

31. The solution set of
$$12x + 15y \le 180$$
$$15x + 10y \le 150$$
$$3x - 8y \le 0$$
$$x, y \ge 0$$
is which region?

(A) I   (B) II   (C) III   (D) IV   (E) V

32. Solve $x^{5/2} = 32$.

(A) 80   (B) 12.8   (C) 1024   (D) 4   (E) none of these

33. Find all values of x such that $a = x + 4$, $b = x - 2$, and $ab = 16$.

(A) -6 (B) $-6, 4$ (C) 4   (D) $-6, 4, 0$ (E) none of these

34. Solve $7(x+8) + 2 = 11x - 4(x-5)$ for x.

(A) 4   (B) $\dfrac{3}{8}$ (C) no solution   (D) all real numbers   (E) none of these

35. Solve the inequality $\dfrac{2x^2 - 13x + 15}{x^2 + 3x + 2} \ge 0$.

(A) $x < -2$ or $-1 < x \le \dfrac{3}{2}$ or $x \ge 5$ (B) $-2 < x < -1$ or $\dfrac{3}{2} \le x \le 5$ (C) $x < -2$ or $1 \le x \le \dfrac{3}{2}$

(D) $-2 < x < -1$ or $x \ge 5$ (E) none of these