OU Math Day 2002

HIGHER ALGEBRA TEST

---

1. If $g(x, y) = x^y - y^{xy}$, what is $g(2, 3)$?

   (A) -721 (B) -720 (C) -55 (D) -50 (E) None of the above.

---

2. What is the slope of a line that is parallel to the line $5x + 3y = 13$?

   (A) $5/3$ (B) $3/5$ (C) $-3/5$ (D) $-5/3$ (E) None of the above.

---

3. CDs and DVDs have the same size cases, but a DVD can hold 7 times as much information. A CD holds 70 minutes of music and a DVD holds 490 minutes of music. If David has 186 cases and 31080 minutes of music, how many DVDs does he have?

   (A) 43 (B) 75 (C) 118 (D) 143 (E) None of the above.

---

4. What is the product when r^x is multiplied by r^p?

   (A) r^{x+p} (B) r^{xp} (C) r^{x-p} (D) r^{p-x} (E) None of the above.

---

5. How many times will graphs of the equations $y = x^2 + 3x - 2$ and $y = 5x^3$ intersect in the Cartesian plane?

   (A) 0 (B) 1 (C) 2 (D) 3 (E) None of the above.

---

6. At what points do the lines $y = 5x + 1$ and $y = 3x + 2$ intersect?

   (A) $(1, 7)$ (B) $(3/8, 113/40)$ (C) $(3/2, 13/2)$ (D) $(1/2, 7/2)$ (E) None of the above.

---

7. The graph of $f(x) = (x - 5)^2 - 1$ does not pass through which of the quadrants?

   (A) I (B) II (C) III (D) IV (E) None of the above.

---

8. The product of two numbers is 378 and their sum is 39. What is the absolute value of the difference between the two numbers?

   (A) 3 (B) 5 (C) 7 (D) 9 (E) None of the above.

---

9. Tom, Bill, and Brian order two large pizzas. Tom eats two slices, while Bill and Brian both have three. If two-thirds of the total amount of pizza is remaining and assuming each of the slices represents an equal portion of the pizza, how many slices were originally in each pizza?

   (A) 30 (B) 24 (C) 18 (D) 12 (E) None of the above.

---

10. If $3x^2 - 7x + 1 = 0$, then possible solutions for x are:

    (A) 3 and 7 (B) 3 and -7 (C) $\dfrac{7 \pm \sqrt{35}}{6}$ (D) $\dfrac{7 \pm \sqrt{37}}{6}$ (E) None of the above.

---

11. Which of the following equals $\frac{1}{3} + \frac{1}{7}$?

    (A) $\frac{1}{10}$ (B) $\frac{1}{5}$ (C) $-\frac{1}{5}$ (D) $\frac{1}{21}$ (E) None of the above.

---

12. If $\log_a(b) = 5$, then what is $\log_{1/a}(b)$?

    (A) 5 (B) 1/5 (C) -5 (D) $-1/5$ (E) None of the above.

---

13. Which of the following is the equation of the circle for which the line segment from $(1, 2)$ to $(3, 8)$ is a diameter?

    (A) $x^2 + y^2 = 5$ (B) $x^2 - 2x + y^2 - 4y + 5 = 0$ (C) $x^2 - 6x + y^2 - 16y + 33 = 0$
    (D) $x^2 - 4x + y^2 - 10y + 19 = 0$ (E) None of the above.

---

14. The line through $(1, 2)$ which is perpendicular to the line $3x + 4y = 100$ is given by the equation:

    (A) $3x + 4y = 11$ (B) $4x - 3y = -2$ (C) $4x + 3y = 10$ (D) $4y - 3x = 5$
    (E) None of the above.

---

15. If $h(x) = \dfrac{1}{1+x}$, then which of the following equals $h(1/x)$?

    (A) $\dfrac{x+1}{1}$ (B) $\dfrac{\frac{1}{x}+1}{1}$ (C) $\dfrac{1}{x}$ (D) $\dfrac{1}{x+1}$ (E) None of the above.

---

16. If $f(x) = x^2 - 3x$ and $g(x) = 5x + 2$, which of the following is equal to $f(g(x)) - g(f(x))$?

    (A) 0 (B) $20x^2 + 20x - 4$ (C) $30x^2 - 20x$ (D) $15x^2 - 12x + 4$ (E) None of the above.

---

17. The length of a rectangle is 3 inches more than the width. If the length is increased by 2 inches and the width by 1 inch, the area is increased by 26 square inches. What is the width of the original rectangle, in inches?

(A)9 in (B) 8 in (C) 7 in (D) 6 in (E) None of the above.

---

18. What is the distance between the points $(-2, 5)$ and $(3, 8)$?

(A) $\sqrt{10}$ (B) $\sqrt{35}$ (C) 6 (D) $\sqrt{34}$ (E) None of the above.

---

19. The Ideal Gas Law states that $PV = nRT$, where P is the pressure, V is the volume, n is the amount of gas present, R is a constant, and T is the absolute temperature. If the pressure is increased, and only one other variable is affected, which of the following describes a possible effect?

I. The absolute temperature increases

II. The volume decreases

III. The amount of gas present decreases

(A) I only (B) II only (C) I & II only (D) I & III only (E) None of the above.

---

20. Simplify the expression $\dfrac{x^3 - x^2 - 10x - 8}{x^3 + 2x^2 - 11x - 12}$

(A) $\dfrac{x^2 + 2x - 8}{x^2 + x - 12}$ (B) $\dfrac{x^2 - 2x - 8}{x^2 + x - 12}$ (C)$\dfrac{x^2 - 2x + 7}{x^2 + x - 12}$ (D) $\dfrac{x^2 - 2x - 8}{x^2 + 3x - 12}$ (E) None of the above.

---

21. Let $A = 2 + 3i$ and $B = 4 - 2i$. Evaluate: $AB - (A + B)$

(A) $8 + 7i$ (B) $8 - 7i$ (C) $4 - 15i$ (D) $-4 + 15i$ (E) None of the above.

---

22. Billy and Tommy wish to build a paper airplane air force. If it takes two minutes for Billy to fold an airplane, and ninety seconds for Tommy to do the same, how long (to the nearest minute) will it take for them to build 500 planes working together?

(A) 7 hrs, 9 min (B) 7 hrs, 7 min (C) 7 hrs, 6 min (D) 7 hrs, 10 min (E) None of the above.

---

23. What is the justification for the following equality?

$$b + c = c + b$$

(A) distributive law (B) associative law of addition (C) commutative law of addition (D) closure for addition of real numbers (E) None of the above.

---

24. If $\log A = 27/10$, $\log B = 41/10$, and $\log C = 16/5$, evaluate $\log(AB/C)$.

(A) 9/5 (B) 21/10 (C) 18/5 (D) 23/5 (E) None of the above.

---

25. In a given function, y is directly proportional to k and inversely proportional to h. Which of the following is an equation that satisfies these conditions?

(A) $y = x/hk$ (B) $y = hx/k$ (C) $y = hkx$ (D) $y = kx/h$ (E) None of the above.
