

Drill Problems: Week 03-7

*Author: Jaehoon Song**Release: 2025-06-15 23:38:18-04:00***Purpose and Usage:**

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**C O L U M B I A A C A D E M Y***enrichment beyond the classroom*

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Written by Jaehoon Song (Lecturer)

1. **X-Intercept** (10 points)

The x -intercept of the graph shown is $(x, 0)$. What is the value of x ?

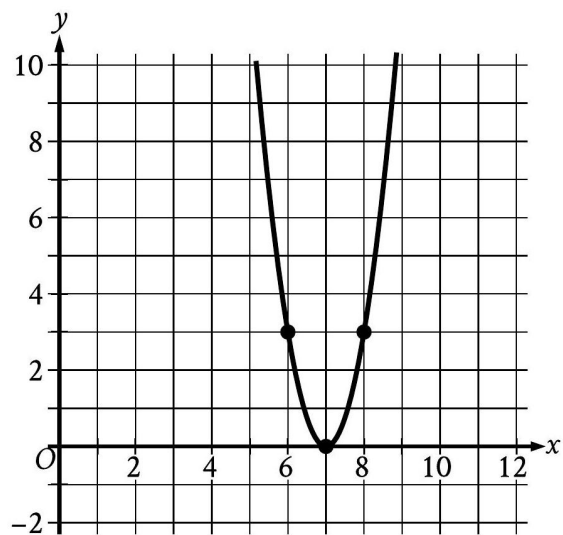


Figure 1: reference attached

Answer:



2. **Graph Equation** (10 points)

Which of the following could be the equation of the graph shown in the xy -plane?

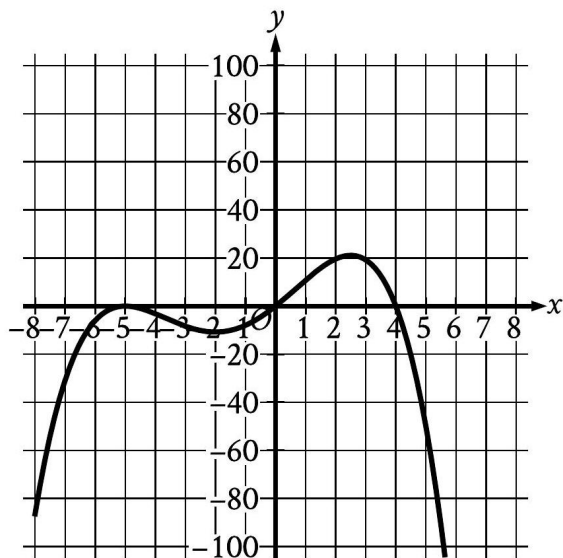


Figure 2: reference attached

- (A) $y = -\frac{1}{10}x(x - 4)(x + 5)$
- (B) $y = -\frac{1}{10}x(x - 4)(x + 5)^2$
- (C) $y = -\frac{1}{10}x(x - 5)(x + 4)$
- (D) $y = -\frac{1}{10}x(x - 5)^2(x + 4)$

Answer:

□

3. **Function Translation** (10 points)

$$f(x) = 4x^2 + 64x + 262$$

The function g is defined by $g(x) = f(x + 5)$. For what value of x does $g(x)$ reach its minimum?

- (A) -13
- (B) -8
- (C) -5
- (D) -3

Answer:

□

4. **Polynomial Roots** (10 points)

The graph of $y = f(x)$ is shown, where the function f is defined by $f(x) = ax^3 + bx^2 + cx + d$ and a, b, c , and d are constants. For how many values of x does $f(x) = 0$?

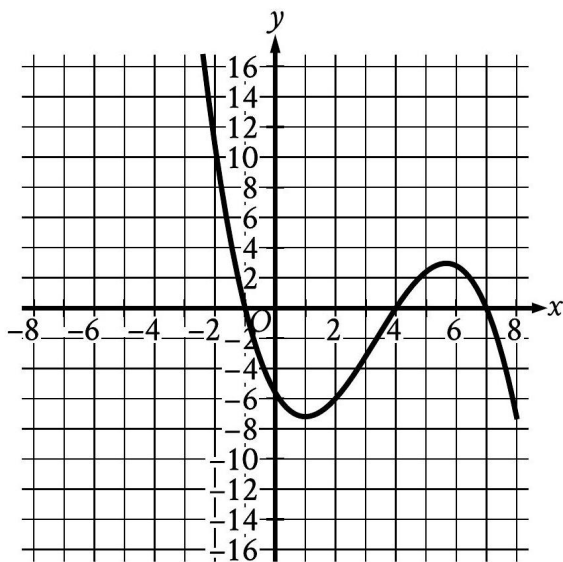


Figure 3: reference attached

- (A) One
- (B) Two
- (C) Three
- (D) Four

Answer:

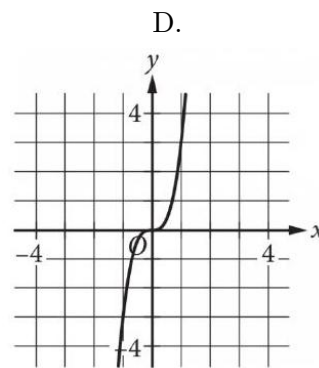
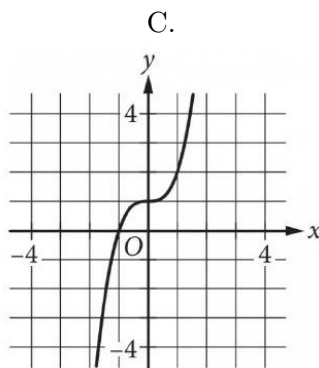
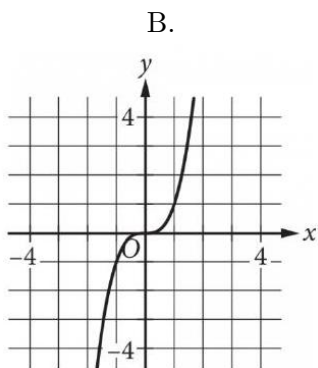
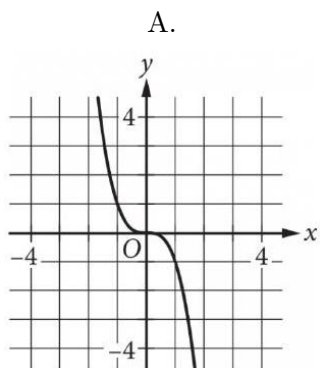


5. **Data Representation** (10 points)

The table shown includes some values of x and their corresponding values of y .

x	y
0	0
1	1
2	8
3	27

Which of the following graphs in the xy -plane could represent the relationship between x and y ?



Answer:

□

6. **Function Translation** (10 points)

The function f is defined by $f(x) = (x - 6)(x - 2)(x + 6)$. In the xy -plane, the graph of $y = g(x)$ is the result of translating the graph of $y = f(x)$ up 4 units. What is the value of $g(0)$?

Answer:

□

7. **Rectangle Area** (10 points)

A rectangle has a length of x units and a width of $(x - 15)$ units. If the rectangle has an area of 76 square units, what is the value of x ?

- (A) 4
- (B) 19
- (C) 23
- (D) 76

Answer:

□

8. **Exponential Growth** (10 points)

A scientist initially measures 12,000 bacteria in a growth medium. 4 hours later, the scientist measures 24,000 bacteria. Assuming exponential growth, the formula $P = C(2)^{rt}$ gives the number of bacteria in the growth medium, where r and C are constants and P is the number of bacteria t hours after the initial measurement. What is the value of r ?

- (A) $\frac{1}{12,000}$
- (B) $\frac{1}{4}$
- (C) 4
- (D) 12,000

Answer:



9. **Projectile Motion** (10 points)

A quadratic function models a projectile's height, in meters, above the ground in terms of the time, in seconds, after it was launched. The model estimates that the projectile was launched from an initial height of 7 meters above the ground and reached a maximum height of 51.1 meters above the ground 3 seconds after the launch. How many seconds after the launch does the model estimate that the projectile will return to a height of 7 meters?

- (A) 3
- (B) 6
- (C) 7
- (D) 9

Answer:



10. **Quadratic Minimum** (10 points)

The given equation relates the variables x and y :

$$y = x^2 - 14x + 22$$

For what value of x does the value of y reach its minimum?

Answer:



11. **Polynomial Simplification** (10 points)

Which expression is equivalent to $11x^3 - 5x^3$?

- (A) $16x^3$
- (B) $6x^3$
- (C) $6x^6$
- (D) $16x^6$

Answer:



12. **Polynomial Addition** (10 points)

Which expression is equivalent to $50x^2 + 5x^2$?

- (A) $250x^2$
- (B) $10x^2$
- (C) $45x^2$
- (D) $55x^2$

Answer:



13. **Polynomial Multiplication** (10 points)

The expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a , b , and c are constants. What is the value of b ?

Answer:



14. **Expression Simplification** (10 points)

Which expression is equivalent to $20w - (4w + 3w)$?

- (A) $10w$
- (B) $13w$
- (C) $19w$
- (D) $21w$

Answer:



15. **Rational Expression** (10 points)

Which expression is equivalent to $\frac{4}{4x-5} - \frac{1}{x+1}$?

- (A) $\frac{1}{(x+1)(4x-5)}$
- (B) $\frac{3}{3x-6}$
- (C) $-\frac{1}{(x+1)(4x-5)}$
- (D) $\frac{9}{(x+1)(4x-5)}$

Answer:



16. **Linear Expression** (10 points)

Which of the following is equivalent to $3(x + 5) - 6$?

- (A) $3x - 3$
- (B) $3x - 1$
- (C) $3x + 9$
- (D) $15x - 6$

Answer:



17. **Rational Expression** (10 points)

In the expression

$$\frac{x^2 - c}{x - b}$$

, b and c are positive integers. If the expression is equivalent to $x + b$ and $x \neq b$, which of the following could be the value of c ?

- (A) 4
- (B) 6
- (C) 8
- (D) 10

Answer:



18. **Radical Expression** (10 points)

Which of the following expressions is equivalent to $\sqrt[3]{x^3y^6}$?

- (A) y^2
- (B) xy^2
- (C) y^3
- (D) xy^3

Answer:

□

19. **Polynomial Multiplication** (10 points)

Which expression is equivalent to $(d - 6)(8d^2 - 3)$?

- (A) $8d^3 - 14d^2 - 3d + 18$
- (B) $8d^3 - 17d^2 + 48$
- (C) $8d^3 - 48d^2 - 3d + 18$
- (D) $8d^3 - 51d^2 + 48$

Answer:

□

20. **Square Difference** (10 points)

If $x^2 = a + b$ and $y^2 = a + c$, which of the following is equal to $(x^2 - y^2)^2$?

- (A) $a^2 - 2ac + c^2$
- (B) $b^2 - 2bc + c^2$
- (C) $4a^2 - 4abc + c^2$
- (D) $4a^2 - 2abc + b^2c^2$

Answer:

□

21. **System of Equations** (10 points)

If the ordered pair (x, y) satisfies the system of equations

$$\begin{aligned}y &= x^2 - 4x + 4 \\y &= 4 - x\end{aligned}$$

what is one possible value of x ?

Answer:

□

22. **Wave Equation** (10 points)

An oceanographer uses the equation

$$s = \frac{3}{2}p$$

to model the speed s , in knots, of an ocean wave, where p represents the period of the wave, in seconds. Which of the following represents the period of the wave in terms of the speed of the wave?

- (A) $p = \frac{2}{3}s$
- (B) $p = \frac{3}{2}s$
- (C) $p = \frac{2}{3} + s$
- (D) $p = \frac{3}{2} + s$

Answer:



23. **Quadratic Equation** (10 points)

Which of the following is a solution to the equation $2x^2 - 4 = x^2$?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Answer:



24. **Linear Equation** (10 points)

The given equation relates the positive numbers q , r , and s :

$$q - 29r = s$$

Which equation correctly expresses q in terms of r and s ?

- (A) $q = s - 29r$
- (B) $q = s + 29r$
- (C) $q = 29rs$
- (D) $q = -\frac{s}{29r}$

Answer:



25. **Quadratic Solutions** (10 points)

In the given equation, a and b are positive constants:

$$57x^2 + (57b + a)x + ab = 0$$

The product of the solutions to the given equation is kab , where k is a constant. What is the value of k ?

- (A) $\frac{1}{57}$
- (B) $\frac{1}{19}$
- (C) 1
- (D) 57

Answer:



26. **Quadratic No Solutions** (10 points)

In the given equation, b is a positive integer:

$$-x^2 + bx - 676 = 0$$

The equation has no real solution. What is the greatest possible value of b ?

Answer:



27. **Rational Equation** (10 points)

The given equation relates the distinct positive numbers p , k , and j :

$$p = \frac{k}{4j + 9}$$

Which equation correctly expresses $4j + 9$ in terms of p and k ?

- (A) $4j + 9 = \frac{k}{p}$
- (B) $4j + 9 = kp$
- (C) $4j + 9 = k - p$
- (D) $4j + 9 = \frac{p}{k}$

Answer:



28. **Quadratic Expression** (10 points)

If $3x^2 - 18x - 15 = 0$, what is the value of $x^2 - 6x$?

Answer:



29. **Intersection Point** (10 points)

In the xy -plane, what is the y -coordinate of the point of intersection of the graphs of $y = (x - 1)^2$ and $y = 2x - 3$?

Answer:



30. **Quadratic No Solutions** (10 points)

In the equation $2x^2 - 4x = t$, t is a constant. If the equation has no real solutions, which of the following could be the value of t ?

(A) -3

(B) -1

(C) 1

(D) 3

Answer:

