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Drill Problems: Week 03-7

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

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COLUMBIA ACADEMY

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Written by Jaehoon Song (Lecturer)

WEEK3.7

1. **X-Intercept** (10 points)
   The x-intercept of the graph shown is $(x, 0)$. What is the value of x?

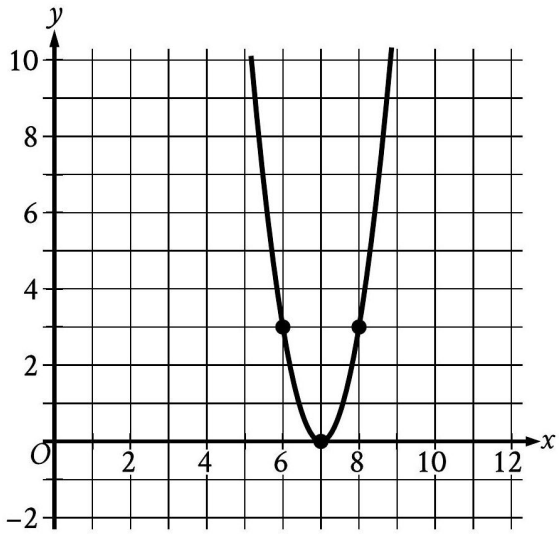


Figure 1: reference attached

Answer:

2. **Graph Equation** (10 points)
Which of the following could be the equation of the graph shown in the xy-plane?

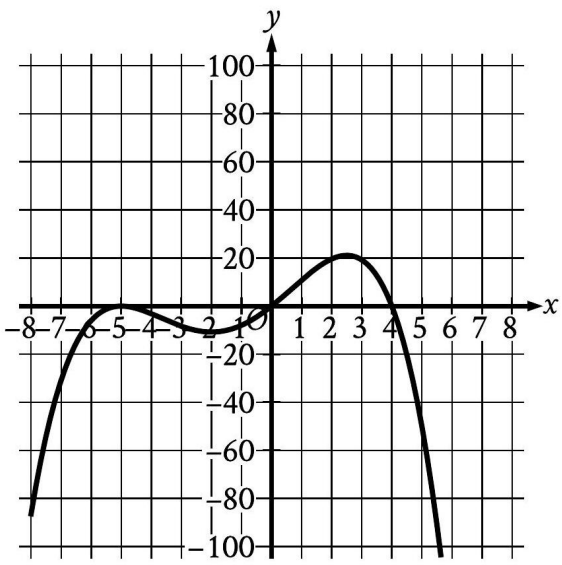


Figure 2: reference attached

(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 $f(x) = 0$?

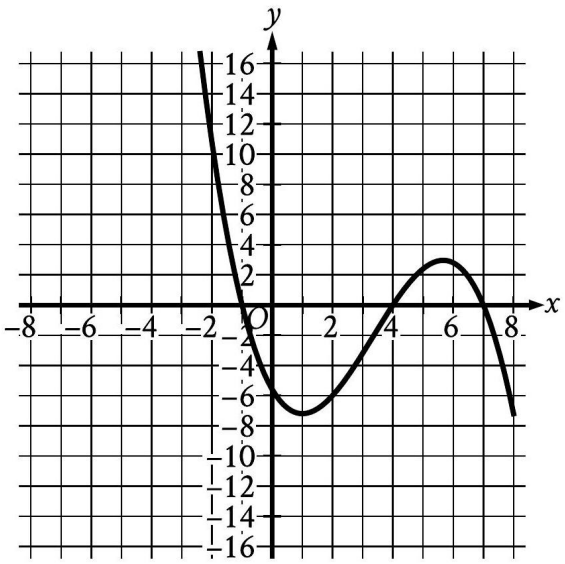


Figure 3: reference attached

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

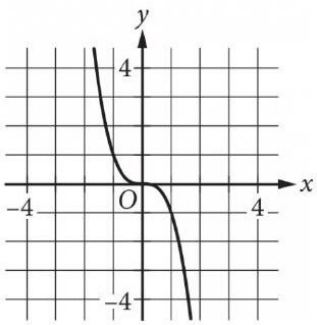
Answer:

5. **Data Representation** (10 points)
The table shown includes some values of x and their corresponding values of y.

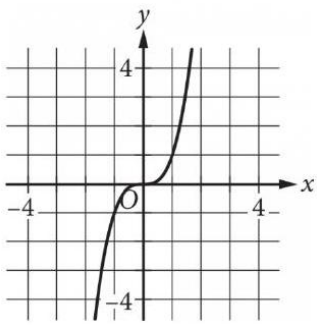
x	y
0	0
1	1
2	8
3	27

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

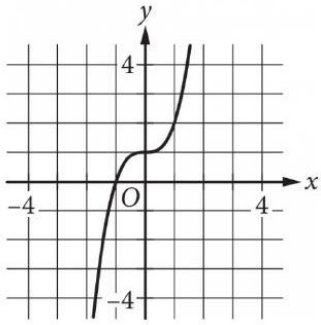
A.



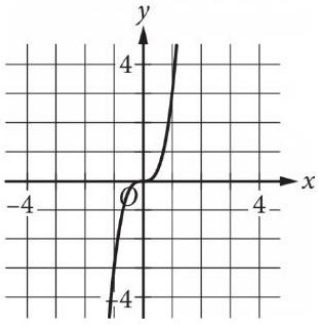
B.



C.



D.



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

$$y=x^2-4x+4$$
$$y=4-x$$

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:

□