GRE 2024 Quant Practice Test 17 with Solutions

Time Allowed : 1 Hour 58 Minutes	Maximum Marks : 340

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The GRE General Test is 1 hour and 58 minutes long (with one optional 10-minute break) and consists of 54 questions in total.
2. The GRE exam is comprised of three sections:
   - Quantitative Reasoning: 27 questions, 47 minutes
   - Verbal Reasoning: 27 questions, 41 minutes
3. You can answer the two sections in any order.
4. As you move through a section, you can skip questions, flag them for review, and return to them later within the same section.
5. When you have answered all questions in a section, you can review your responses before time expires.
6. If there is no time remaining in the section, you will automatically be moved to your optional break screen or the next section (if you have already taken your optional break).
7. Each review screen includes a numbered list of the questions in that section and indicates the questions you flagged.
8. Clicking a question number will take you to that specific question.
9. You may change any answer within the time allowed for that section.

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1. Given the functions f(x) = 2x + 4 and g(x) = 3x - 6, what is f(g(x)) when x = 6?

(A) 144
(B) 12
(C) 28
(D) 192
(E) 16

Correct Answer: (C) 28

Solution:

Step 1: Understanding the Concept:
This problem involves the composition of two functions, denoted as $f(g(x))$. This means we first evaluate the inner function, $g(x)$, at the given value of x, and then use that result as the

input for the outer function, $f(x)$.

Step 2: Detailed Explanation:
We are asked to find the value of $f(g(x))$ when $x = 6$.
First, we need to calculate $g(6)$.
The function $g(x)$ is given by $g(x) = 3x - 6$.
Substitute $x = 6$ into $g(x)$:

$$g(6) = 3(6) - 6$$
$$g(6) = 18 - 6$$
$$g(6) = 12$$

Now that we have the value of $g(6)$, we use this result as the input for the function $f(x)$.
We need to find $f(g(6))$, which is $f(12)$.
The function $f(x)$ is given by $f(x) = 2x + 4$.
Substitute $x = 12$ into $f(x)$:

$$f(12) = 2(12) + 4$$
$$f(12) = 24 + 4$$
$$f(12) = 28$$

Step 3: Final Answer:
Therefore, the value of $f(g(x))$ when $x = 6$ is 28.

> Quick Tip
>
> For composite functions like $f(g(x))$, always work from the inside out. First, evaluate the inner function $g(x)$ for the given value, then plug that result into the outer function $f(x)$.

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2. A jet goes from City 1 to City 2 at an average speed of 600 miles per hour, and returns along the same path at an average speed of 300 miles per hour. What is the average speed, in miles per hour, for the trip?

(A) 300 miles/hour
(B) 400 miles/hour
(C) 350 miles/hour
(D) 450 miles/hour
(E) 500 miles/hour

Correct Answer: (B) 400 miles/hour

Solution:

Step 1: Understanding the Concept:
Average speed is calculated as Total Distance divided by Total Time. It is a common mistake to simply take the arithmetic average of the two speeds, especially when the time taken for each part of the journey is different.

Step 2: Key Formula or Approach:
Let d be the distance between City 1 and City 2.
The formula for time is Time $= \frac{\text{Distance}}{\text{Speed}}$.
The formula for average speed is Average Speed $= \frac{\text{Total Distance}}{\text{Total Time}}$.

Step 3: Detailed Explanation:
Let's calculate the time for each leg of the journey.
Time to go from City 1 to City 2 (t_1):

$$t_1 = \frac{d}{600} \text{ hours}$$

Time to return from City 2 to City 1 (t_2):

$$t_2 = \frac{d}{300} \text{ hours}$$

Now, let's find the total distance and total time for the entire trip.
Total Distance = Distance to City 2 + Distance back $= d + d = 2d$.
Total Time $= t_1 + t_2 = \frac{d}{600} + \frac{d}{300}$.
To add the fractions, we find a common denominator, which is 600.

$$\text{Total Time} = \frac{d}{600} + \frac{2d}{600} = \frac{3d}{600} = \frac{d}{200} \text{ hours}$$

Now we can calculate the average speed:

$$\text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}} = \frac{2d}{\frac{d}{200}}$$

$$\text{Average Speed} = 2d \times \frac{200}{d}$$

The d terms cancel out.

$$\text{Average Speed} = 2 \times 200 = 400 \text{ miles/hour}$$

Step 4: Final Answer:
The average speed for the entire trip is 400 miles/hour.

Quick Tip

When an object travels the same distance at two different speeds, v_1 and v_2, the average speed is the harmonic mean of the two speeds, not the arithmetic mean. The formula is: Average Speed $= \frac{2v_1v_2}{v_1+v_2}$. In this case: $\frac{2(600)(300)}{600+300} = \frac{360000}{900} = 400$ mph.

3. If f(x)=3x+7 and g(x)=x²-12, what is f(g(x))?

(A) $3x^3$-29
(B) $9x^2$-29
(C) $3x^2$+29
(D) $3x^2$-29
(E) $9x^3$+29

Correct Answer: (D) $3x^2$-29

Solution:

Step 1: Understanding the Concept:
The notation $f(g(x))$ represents a composite function. To find the expression for $f(g(x))$, we substitute the entire expression for the inner function, $g(x)$, into every instance of x in the outer function, $f(x)$.

Step 2: Detailed Explanation:
We are given the functions:
$f(x) = 3x + 7$
$g(x) = x^2 - 12$
To find $f(g(x))$, we take the expression for $g(x)$ and plug it into $f(x)$.

$$f(g(x)) = f(x^2 - 12)$$

Now, in the function $f(x) = 3x + 7$, we replace x with $(x^2 - 12)$.

$$f(g(x)) = 3(x^2 - 12) + 7$$

Next, we simplify the expression by distributing the 3.

$$f(g(x)) = 3x^2 - 3(12) + 7$$
$$f(g(x)) = 3x^2 - 36 + 7$$

Finally, combine the constant terms.

$$f(g(x)) = 3x^2 - 29$$

Step 3: Final Answer:
The composite function $f(g(x))$ is $3x^2 - 29$.

Quick Tip

Be careful with the order of operations. In $f(g(x))$, $g(x)$ is the input for f. If the question asked for $g(f(x))$, you would substitute $f(x)$ into $g(x)$, which would yield a different result: $(3x + 7)^2 - 12$.

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4. What is f(-3) if f(x) = x^2 + 5?

(A) -14
(B) 4
(C) 15
(D) 14
(E) -4

Correct Answer: (D) 14

Solution:

Step 1: Understanding the Concept:
This question asks to evaluate a function, $f(x)$, at a specific value of x. To find $f(-3)$, we need to substitute -3 for every x in the expression for $f(x)$.

Step 2: Detailed Explanation:
The given function is $f(x) = x^2 + 5$.
We need to find the value of $f(-3)$.
Substitute $x = -3$ into the function:

$$f(-3) = (-3)^2 + 5$$

When squaring a negative number, the result is positive.

$$f(-3) = 9 + 5$$

Now, perform the addition.

$$f(-3) = 14$$

Step 3: Final Answer:
The value of $f(-3)$ is 14.

Quick Tip

A common mistake is incorrectly handling the negative sign when squaring. Remember that $(-a)^2 = (-a) \times (-a) = a^2$. Always use parentheses when substituting a negative value to avoid errors, especially with calculators.

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5. An outpost has the supplies to last 2 people for 14 days. How many days will the supplies last for 7 people?

(A) 4
(B) 9
(C) 5

(D) 10
(E) 7

Correct Answer: (A) 4

Solution:

Step 1: Understanding the Concept:
This is an inverse proportion problem. The number of people and the number of days the supplies last are inversely related. This means that if the number of people increases, the number of days the supplies will last must decrease, assuming the consumption rate per person is constant.

Step 2: Key Formula or Approach:
First, calculate the total amount of supplies in "person-days". A "person-day" is the amount of supply one person consumes in one day.
Total Supplies (in person-days) = (Number of people) × (Number of days).
Then, find the new number of days by dividing the total supplies by the new number of people.
Days = Total Supplies / New number of people.

Step 3: Detailed Explanation:
Calculate the total supplies available.

$$\text{Total Supplies} = 2 \text{ people} \times 14 \text{ days} = 28 \text{ person-days}$$

This means the outpost has enough supplies to feed one person for 28 days, or 28 people for one day, etc.
Now, we want to find out how long these 28 person-days of supplies will last for 7 people.

$$\text{Number of days for 7 people} = \frac{\text{Total Supplies}}{\text{Number of people}}$$

$$\text{Number of days} = \frac{28 \text{ person-days}}{7 \text{ people}} = 4 \text{ days}$$

Step 4: Final Answer:
The supplies will last for 4 days if there are 7 people.

Quick Tip

For inverse proportion problems ($y \propto 1/x$), the product of the two quantities is constant ($k = x \cdot y$). Here, $P_1 \times D_1 = P_2 \times D_2$. So, $2 \times 14 = 7 \times D_2$, which gives $28 = 7 \times D_2$, and $D_2 = 4$. This is a quick way to set up and solve such problems.

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6. Given f(x)=3x²-5 and g(x)=9-2x, find f(g(5)).

(A) -1
(B) 4

(C) 131
(D) -2
(E) 70

Correct Answer: (D) -2

Solution:

Step 1: Understanding the Concept:
This problem asks for the value of a composite function, $f(g(x))$, at a specific point, $x = 5$. The process is to first evaluate the inner function, $g(5)$, and then use the result as the input for the outer function, $f(x)$.

Step 2: Detailed Explanation:
We need to find $f(g(5))$.
First, let's find the value of the inner function, $g(5)$.
The function $g(x)$ is given by $g(x) = 9 - 2x$.
Substitute $x = 5$ into $g(x)$:

$$g(5) = 9 - 2(5)$$
$$g(5) = 9 - 10$$
$$g(5) = -1$$

Now, we take this result, -1, and use it as the input for the function $f(x)$.
We need to find $f(g(5))$, which is now $f(-1)$.
The function $f(x)$ is given by $f(x) = 3x^2 - 5$.
Substitute $x = -1$ into $f(x)$:

$$f(-1) = 3(-1)^2 - 5$$

Remember that $(-1)^2 = 1$.

$$f(-1) = 3(1) - 5$$
$$f(-1) = 3 - 5$$
$$f(-1) = -2$$

Step 3: Final Answer:
Therefore, the value of $f(g(5))$ is -2.

Quick Tip

Always follow the "inside-out" rule for composite functions. Solving for $g(5)$ first simplifies the problem into two distinct, easier steps. Avoid the temptation to first find the general expression for $f(g(x))$ and then substitute $x = 5$, as it can be more time-consuming and prone to algebraic errors.

7. Find f(6) if f(x)=—x²+4x-127—

(A) -136
(B) -36
(C) -67
(D) 67
(E) 36

Correct Answer: (D) 67

Solution:

Step 1: Understanding the Concept:
The problem asks to evaluate a function involving an absolute value at a specific point. The absolute value of a number, denoted by $|a|$, is its distance from zero on the number line. It is always non-negative. For any real number a, if $a \geq 0$, then $|a| = a$, and if $a < 0$, then $|a| = -a$.

Step 2: Detailed Explanation:
The function is given by $f(x) = |x^2 + 4x - 127|$.
We need to find the value of $f(6)$.
First, substitute $x = 6$ into the expression inside the absolute value bars.

$$f(6) = |(6)^2 + 4(6) - 127|$$

Calculate the terms inside the bars.

$$f(6) = |36 + 24 - 127|$$

Perform the addition.

$$f(6) = |60 - 127|$$

Perform the subtraction.

$$f(6) = |-67|$$

Finally, take the absolute value of -67. The absolute value of a negative number is its positive counterpart.

$$f(6) = 67$$

Step 3: Final Answer:
The value of $f(6)$ is 67.

Quick Tip

When dealing with absolute value functions, first evaluate the entire expression inside the absolute value bars. Only after you have a single number inside do you apply the absolute value rule. If the result is negative, make it positive. If it's positive or zero, leave it as is.

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8. A function f(x) = -1 for all values of x. Another function g(x) = 3x for all values of x. What is g(f(x)) when x = 4?

(A) -12
(B) -3
(C) 3
(D) -1
(E) 12

Correct Answer: (B) -3

Solution:

Step 1: Understanding the Concept:
This problem involves the composition of two functions, $g(f(x))$, where one of the functions, $f(x)$, is a constant function. A constant function always outputs the same value, regardless of the input.

Step 2: Detailed Explanation:
We are asked to find the value of $g(f(x))$ when $x = 4$, which can be written as $g(f(4))$.
First, we must evaluate the inner function, $f(4)$.
The problem states that $f(x) = -1$ for all values of x. This means that no matter what input we provide for f, the output will always be -1.
Therefore, $f(4) = -1$.
Now we can substitute this result into the outer function, $g(x)$.
We need to find $g(f(4))$, which is now $g(-1)$.
The function $g(x)$ is given by $g(x) = 3x$.
Substitute $x = -1$ into $g(x)$:

$$g(-1) = 3(-1)$$
$$g(-1) = -3$$

Step 3: Final Answer:
The value of $g(f(x))$ when $x = 4$ is -3.

Quick Tip

When a constant function is the inner function in a composition, like $g(f(x))$ where $f(x) = c$, the final result will be $g(c)$ and will not depend on the initial variable x. The specific value of x (in this case, $x = 4$) is irrelevant to the final answer.

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9. Worker A can make a trinket in 4 hours, Worker B can make a trinket in 2 hours. When they work together, how long will it take them to make a trinket?

(A) 6 hours
(B) $\frac{1}{2}$ hour
(C) $1\frac{1}{3}$ hours
(D) 3 hours
(E) $1\frac{1}{2}$ hours

Correct Answer: (C) $1\frac{1}{3}$ hours

Solution:

Step 1: Understanding the Concept:
This is a work-rate problem. To find the combined time it takes for two workers to complete a task together, we first need to determine their individual rates of work. The combined rate is the sum of their individual rates. The time taken is the reciprocal of the combined rate.

Step 2: Key Formula or Approach:
The rate of work is the amount of work done per unit of time.

$$\text{Rate} = \frac{\text{Work}}{\text{Time}}$$

If two workers have rates R_A and R_B, their combined rate is $R_{Total} = R_A + R_B$.
The time it takes to complete one unit of work together is $T_{Total} = \frac{1}{R_{Total}}$.

Step 3: Detailed Explanation:
First, let's find the individual rates of Worker A and Worker B. The work is "making 1 trinket".
Rate of Worker A (R_A):

$$R_A = \frac{1 \text{ trinket}}{4 \text{ hours}} = \frac{1}{4} \text{ trinket/hour}$$

Rate of Worker B (R_B):

$$R_B = \frac{1 \text{ trinket}}{2 \text{ hours}} = \frac{1}{2} \text{ trinket/hour}$$

Next, we find their combined rate by adding their individual rates.

$$R_{Total} = R_A + R_B = \frac{1}{4} + \frac{1}{2}$$

To add these fractions, we find a common denominator, which is 4.

$$R_{Total} = \frac{1}{4} + \frac{2}{4} = \frac{3}{4} \text{ trinket/hour}$$

This means that working together, they can make $\frac{3}{4}$ of a trinket in one hour.
Finally, to find the time it takes to make one whole trinket, we take the reciprocal of the combined rate.

$$T_{Total} = \frac{1}{R_{Total}} = \frac{1}{\frac{3}{4}} = \frac{4}{3} \text{ hours}$$

To express this as a mixed number:

$$\frac{4}{3} \text{ hours} = 1\frac{1}{3} \text{ hours}$$

Step 4: Final Answer:
Working together, it will take them $1\frac{1}{3}$ hours to make a trinket.

Quick Tip

For problems where two people work together, a useful shortcut formula is $T_{Total} = \frac{T_A \times T_B}{T_A + T_B}$, where T_A and T_B are the individual times. In this case, $T_{Total} = \frac{4 \times 2}{4+2} = \frac{8}{6} = \frac{4}{3}$ hours.

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10. For all values of x, f(x) = 7x² - 3, and for all values of y, g(y) = 2y + 9. What is g(f(x))?

(A) 7y² - 3
(B) 14x² + 3
(C) 14y² + 3
(D) 14x² - 3
(E) 2x + 9

Correct Answer: (B) 14x² + 3

Solution:

Step 1: Understanding the Concept:
The notation $g(f(x))$ represents the composition of two functions. It means we take the function $f(x)$ and use its entire output as the input for the function g. Note that the variable in $g(y)$ is just a placeholder; $g(y) = 2y + 9$ is the same rule as $g(z) = 2z + 9$ or $g(\text{input}) = 2(\text{input}) + 9$.

Step 2: Detailed Explanation:
We are given the functions:
$f(x) = 7x^2 - 3$
$g(y) = 2y + 9$

To find the composite function $g(f(x))$, we substitute the expression for $f(x)$ in place of the input variable y in the function $g(y)$.

$$g(f(x)) = g(7x^2 - 3)$$

Now, we apply the rule for g, which is to multiply the input by 2 and then add 9.

$$g(f(x)) = 2(7x^2 - 3) + 9$$

Distribute the 2 across the terms in the parentheses.

$$g(f(x)) = 2(7x^2) - 2(3) + 9$$
$$g(f(x)) = 14x^2 - 6 + 9$$

Finally, combine the constant terms.

$$g(f(x)) = 14x^2 + 3$$

Step 3: Final Answer:
The expression for the composite function $g(f(x))$ is $14x^2 + 3$.

Quick Tip

Don't be confused by the different variables x and y. They are just placeholders for the inputs of their respective functions. When finding $g(f(x))$, simply replace the input variable of the outer function g with the entire expression of the inner function f.

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11. The operation is defined as a b = a(b+1) - 3.
Compare Quantity A and Quantity B.
Quantity A: 1 1
Quantity B: 2 0

(A) The relationship cannot be determined from the information given.
(B) Quantity A is greater.
(C) Quantity A and Quantity B are equal.
(D) Quantity B is greater.

Correct Answer: (C) Quantity A and Quantity B are equal.

Solution:

Step 1: Understanding the Concept:
This problem defines a new mathematical operation, . To solve the problem, we must apply the given rule for this operation to evaluate both Quantity A and Quantity B, and then compare their values.

Step 2: Detailed Explanation:
The rule for the operation is given by: $a \quad b = a(b + 1) - 3$.

Calculate Quantity A:
For Quantity A, we have 1 1. Here, $a = 1$ and $b = 1$.
Substitute these values into the rule:

$$\text{Quantity A} = 1(1 + 1) - 3$$
$$\text{Quantity A} = 1(2) - 3$$
$$\text{Quantity A} = 2 - 3$$
$$\text{Quantity A} = -1$$

Calculate Quantity B:
For Quantity B, we have 2 0. Here, $a = 2$ and $b = 0$.
Substitute these values into the rule:

$$\text{Quantity B} = 2(0 + 1) - 3$$
$$\text{Quantity B} = 2(1) - 3$$
$$\text{Quantity B} = 2 - 3$$
$$\text{Quantity B} = -1$$

Compare the Quantities:
We found that Quantity A = -1 and Quantity B = -1.
Therefore, Quantity A and Quantity B are equal.

Step 3: Final Answer:
The two quantities are equal.

> **Quick Tip**
>
> For problems with custom-defined operators, read the rule carefully. Substitute the numbers in the correct positions (the first number for 'a' and the second for 'b') and follow the order of operations (parentheses, multiplication, then subtraction).

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12. Alice is twice as old as Tom, but four years ago, she was three years older than Tom is now. How old is Tom now?

(A) 7
(B) 13
(C) 21
(D) 3
(E) 9

Correct Answer: (A) 7

Solution:

Step 1: Understanding the Concept:
This is a classic age word problem that can be solved by setting up a system of linear equations based on the information given. We need to define variables for the current ages and translate the sentences into mathematical equations.

Step 2: Key Formula or Approach:
Let A be Alice's current age.
Let T be Tom's current age.
We will form two equations from the two statements in the problem and solve for T.

Step 3: Detailed Explanation:
Translate the first statement into an equation:
"Alice is twice as old as Tom" can be written as:

$$A = 2T \quad \text{(Equation 1)}$$

Translate the second statement into an equation:
"four years ago, she was..." refers to Alice's age 4 years ago, which is $A - 4$.
"...three years older than Tom is now." refers to Tom's current age (T) plus 3.
So, this statement can be written as:

$$A - 4 = T + 3 \quad \text{(Equation 2)}$$

Now we have a system of two equations with two variables. We can solve this system by substitution. Substitute the expression for A from Equation 1 into Equation 2.

$$(2T) - 4 = T + 3$$

Now, solve for T. Start by getting the T terms on one side of the equation. Subtract T from both sides:

$$2T - T - 4 = 3$$
$$T - 4 = 3$$

Now, get the constant terms on the other side. Add 4 to both sides:

$$T = 3 + 4$$
$$T = 7$$

So, Tom is currently 7 years old.

Verification (Optional):
If Tom is 7, then Alice is $A = 2T = 2(7) = 14$.
Four years ago, Alice was $14 - 4 = 10$.
Is 10 three years older than Tom is now (7)? Yes, $10 = 7 + 3$. The conditions are met.

Step 4: Final Answer:
Tom is 7 years old now.

Quick Tip

In age problems, carefully distinguish between past, present, and future ages. "Four years ago" means you subtract 4 from the current age. "Tom is now" refers to the current age variable T, not his age in the past. Reading each phrase carefully is key to setting up the correct equations.

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13. If the average of two numbers is 3y and one of the numbers is y + z, what is the other number, in terms of y and z?

(A) 5y + z
(B) 4y - z
(C) 3y + z
(D) 5y - z
(E) y + z

Correct Answer: (D) 5y - z

Solution:

Step 1: Understanding the Concept:
The average (or arithmetic mean) of a set of numbers is their sum divided by the count of the numbers. This problem can be solved by using the definition of an average to find the sum of the two numbers, and then subtracting the known number to find the unknown one.

Step 2: Key Formula or Approach:

$$\text{Average} = \frac{\text{Sum of numbers}}{\text{Count of numbers}}$$

From this, we can derive:

$$\text{Sum of numbers} = \text{Average} \times \text{Count of numbers}$$

Step 3: Detailed Explanation:
Let the two numbers be N_1 and N_2.
We are given that their average is $3y$. Since there are two numbers, the count is 2.
Using the formula for the sum:

$$\text{Sum} = N_1 + N_2 = 3y \times 2 = 6y$$

We are given that one of the numbers is $y + z$. Let's set $N_1 = y + z$.
We need to find the other number, N_2. We can rearrange the sum equation:

$$N_2 = \text{Sum} - N_1$$

Substitute the values we know:

$$N_2 = 6y - (y + z)$$

It is important to use parentheses to ensure we subtract the entire expression. Distribute the negative sign:

$$N_2 = 6y - y - z$$

Combine the like terms (the y terms):

$$N_2 = 5y - z$$

Step 4: Final Answer:
The other number is $5y - z$.

Quick Tip

A quick way to think about averages is in terms of balance. If the average is $3y$, the sum must be $2 \times 3y = 6y$. If you have one part $(y + z)$, the other part must be whatever is needed to reach the total sum: $(y+z)+? = 6y$. Solving for the unknown gives $6y-(y+z)$.

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14. What is the value of the function f(x) = 6x² + 16x - 6 when x = -3?

(A) -108
(B) -12
(C) 0
(D) 96

Correct Answer: (C) 0

Solution:

Step 1: Understanding the Concept:
To evaluate a function at a specific value, we substitute that value for the variable (x) everywhere it appears in the function's expression. Then, we simplify the expression using the standard order of operations (PEMDAS/BODMAS).

Step 2: Detailed Explanation:
The function is given by $f(x) = 6x^2 + 16x - 6$.
We need to find the value of $f(-3)$.
Substitute $x = -3$ into the expression:

$$f(-3) = 6(-3)^2 + 16(-3) - 6$$

First, calculate the exponent. Remember that squaring a negative number results in a positive number.

$$(-3)^2 = 9$$

Substitute this back into the equation:

$$f(-3) = 6(9) + 16(-3) - 6$$

Next, perform the multiplications.

$$6(9) = 54$$
$$16(-3) = -48$$

Substitute these values back:

$$f(-3) = 54 - 48 - 6$$

Finally, perform the subtraction from left to right.

$$f(-3) = (54 - 48) - 6$$
$$f(-3) = 6 - 6$$
$$f(-3) = 0$$

Step 3: Final Answer:
The value of the function when $x = -3$ is 0.

Quick Tip

When substituting negative numbers, always use parentheses to avoid calculation errors. For example, writing -3^2 is ambiguous and often interpreted as $-(3^2) = -9$, whereas the correct evaluation requires $(-3)^2 = 9$. Using parentheses clarifies the operation and helps prevent common mistakes.
