Function Notation

Name: ____________ Date: ____________ Score: ______ / 24

Quick Review

Function notation writes the output of a function with a name and an input slot. So $f(x)$ is read *"f of x"* — it names the output, not multiplication. To **evaluate** $f(c)$, replace every x in the rule with c (parentheses help with negatives and complicated inputs).

Quick check: if $f(x) = 2x + 5$, then $f(3) = 2(3) + 5 = 11$, and $f(-2) = 2(-2) + 5 = 1$. If the input is itself an expression, swap the *whole* expression in: $f(2a) = 2(2a) + 5 = 4a + 5$ and $f(x + 1) = 2(x + 1) + 5 = 2x + 7$.

You can also work backwards: **solve for the input** given an output. If $f(a) = 7$ with $f(x) = 4x - 9$, set $4a - 9 = 7$ and solve to get $a = 4$.

Common traps. $f(a + b)$ is *not* $f(a) + f(b)$ in general (test it with $f(x) = x^2$: $f(1 + 2) = 9$ but $f(1) + f(2) = 5$). The notation $f^{-1}(x)$ means the inverse function, not the reciprocal $\frac{1}{f(x)}$. And $f(0)$ usually isn't 0 — for $f(x) = x + 5$, $f(0) = 5$.

PRACTICE

Evaluate each function. For input questions, solve carefully.

1. $f(x) = 2x + 5;\ f(3)$ ________
2. $g(x) = x^2 + 4;\ g(-2)$ ________
3. $f(x) = 3x - 1;\ f(2a)$ ________
4. $h(x) = x^2 - 3x;\ h(x + 1)$ ________
5. $f(x) = 4x - 9$. Find a if $f(a) = 7$. ________
6. $f(x) = 2x^2 - 5x + 1;\ f(-3)$ ________
7. $m(t) = -3t^2 + 12t + 7;\ m(5)$ ________
8. $f(x) = x^2;\ \dfrac{f(x + h) - f(x)}{h},\ h \neq 0$ ________
9. $f(x) = 5 - 2x;\ f(0) + f(3)$ ________
10. $g(x) = \sqrt{x + 5};\ g(11)$ ________
11. $f(x) = 2x^2 - 5x;$ solve $f(x) = 0$ ________
12. $P(n) = 12n - 50;\ P(8)$ ________
13. $f(x) = \dfrac{x + 1}{x - 2};\ f(3)$ ________
14. $f(x) = 3x + 2;\ f(a + 1) - f(a)$ ________
15. $g(x) = x^2 + 1$; is $g(-x) = g(x)$? ________
16. $f(x) = x^2$; does $f(1 + 2) = f(1) + f(2)$? ________
17. $f(x) = -x^2 + 4x;\ f(2)$ ________
18. $C(n) = 35n + 120$ models room rental in dollars for n hours. What does $C(4)$ represent? ________

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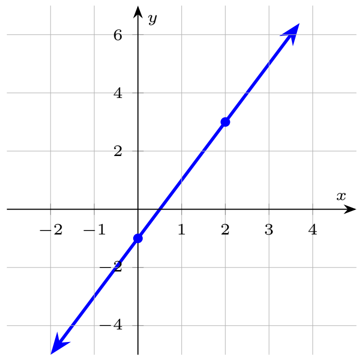
19. Use the graph of f below to read off $f(1)$, and the value of x for which $f(x) = 5$. ______



20. The table lists values of g. Find $g(2)$, and the x for which $g(x) = 4$. ______

x	-2	-1	0	1	2
$g(x)$	10	7	4	1	-2

♦ Word Problems

21. A taxi charges a flat $\$3.50$ start fee plus $\$2$ per mile. The total cost is $C(m) = 2m + 3.50$ dollars, where m is miles driven. Find $C(7)$ and explain what it means in context. ____

22. A ball's height t seconds after being thrown is $h(t) = -16t^2 + 48t + 5$ feet. Find $h(2)$ and explain what it tells you. ____

23. A phone plan costs $P(t) = 0.05t + 25$ dollars for t minutes of talk in a month. If a customer paid $\$42$ last month, how many minutes did they use? ____

24. For the function $f(x) = x^2 - 4x + 7$, a student claims $f(1 + 3) = f(1) + f(3)$. Check whether that's true. ____

Answer Keys

1. $\boxed{11}$
2. $\boxed{8}$
3. $\boxed{6a-1}$
4. $\boxed{x^2-x-2}$
5. $\boxed{a=4}$
6. $\boxed{34}$
7. $\boxed{-8}$
8. $\boxed{2x+h}$
9. $\boxed{4}$
10. $\boxed{4}$
11. $\boxed{x=0 \text{ or } x=\frac{5}{2}}$
12. $\boxed{46}$
13. $\boxed{4}$
14. $\boxed{3}$
15. $\boxed{yes}$
16. $\boxed{no}$
17. $\boxed{4}$
18. $\boxed{\text{the total cost for 4 hours of rental}}$
19. $\boxed{f(1)=1;\ x=3}$
20. $\boxed{g(2)=-2;\ x=0}$
21. $\boxed{C(7)=17.50;\ \text{a 7-mile ride costs \$17.50}}$
22. $\boxed{h(2)=37 \text{ feet}}$
23. $\boxed{340 \text{ minutes}}$
24. $\boxed{\text{false; } f(4)=7,\ f(1)+f(3)=4+4=8}$

Step-by-Step Explanations

1. A careful way to see it: Substitute 3 for x: $f(3)=2(3)+5=11$. This is the part to check before moving on, because it keeps the answer tied to the original question.

2. Use parentheses on the negative: $g(-2)=(-2)^2+4=4+4=8$. The square kills the negative.

3. One steady path is: Substitute the entire expression $2a$: $f(2a)=3(2a)-1=6a-1$. That gives a quick check on the answer.

4. Swap the whole input in: $h(x+1)=(x+1)^2-3(x+1)$. Expand: $x^2+2x+1-3x-3=x^2-x-2$.

5. This time you know the output and want the input, so work backwards. Replace $f(a)$ with 7: $4a-9=7$. Add 9 to both sides to get $4a=16$, then divide by 4 to find $a=4$. Check: $4(4)-9=7$.

6. Keep the rule visible: $f(-3)=2(9)-5(-3)+1=18+15+1=34$. Watch the double negative: $-5(-3)=+15$. That gives a quick check on the answer.

7. One steady path is: $m(5)=-3(25)+12(5)+7=-75+60+7=-8$. This is the part to check before moving on, because it keeps the answer tied to the original question.

8. Start with the key idea: $f(x+h)=(x+h)^2=x^2+2xh+h^2$. Subtract $f(x)=x^2$: $2xh+h^2$. Divide by h: $2x+h$. That gives a quick check on the answer.

9. A careful way to see it: $f(0)=5$ and $f(3)=5-6=-1$. Sum: $5+(-1)=4$. This is the part to check before moving on, because it keeps the answer tied to the original question.

10. Keep the rule visible: $g(11)=\sqrt{16}=4$. The principal square root is positive. This is the part to check before moving on, because it keeps the answer tied to the original question.

11. Solving $f(x)=0$ means setting the rule equal to zero: $2x^2-5x=0$. Factor out the common x: $x(2x-5)=0$. By the zero-product rule, either $x=0$ or $2x-5=0$, and the second gives $x=\frac{5}{2}$. Both are valid solutions.

12. Substitute 8 for n: $P(8)=12(8)-50$. Multiply first ($12\times 8=96$), then subtract: $96-50=46$.

13. Substitute 3 for x in both the top and the bottom: $f(3)=\dfrac{3+1}{3-2}=\dfrac{4}{1}=4$. Since the denominator isn't zero at $x=3$, the value is defined.

14. Keep the rule visible: $f(a+1)=3a+5$ and $f(a)=3a+2$. Difference: 3. (For a linear function, this difference always equals the slope.) That gives a quick check on the answer.

15. One steady path is: $g(-x)=(-x)^2+1=x^2+1=g(x)$. The even power kills the sign, so the function is symmetric across the y-axis. That gives a quick check on the answer.

16. Start with the key idea: $f(1+2)=f(3)=9$ but $f(1)+f(2)=1+4=5$. Function notation is not distributive — $f(a+b)\neq f(a)+f(b)$ in general. That gives a quick check on the answer.

17. Substitute 2 for x: $f(2)=-(2)^2+4(2)=-4+8=4$. Square before negating, so $-(2)^2=-4$, not 4. (The vertex of this downward parabola sits at $x=2$, so 4 is its maximum value.)

18. The input is hours, the output is total cost. So $C(4)$ is the cost when $n=4$: $C(4)=35(4)+120=260$ dollars.

19. The line passes through $(0,-1)$ and $(2,3)$, so its slope is 2 and $f(x)=2x-1$. Reading the graph at $x=1$ gives $f(1)=1$. To find where $f(x)=5$, follow the line up to height 5: it sits above $x=3$ (check: $2(3)-1=5$).

20. A table of a function pairs each input with one output. Read straight down the $x=2$ column: $g(2)=-2$. For the second part, hunt for 4 in the $g(x)$ row – it sits above $x=0$, so $g(x)=4$ when $x=0$.

21. Substitute $m=7$: $C(7)=2(7)+3.50=14+3.50=17.50$. That means a seven-mile ride costs \$17.50 total — the \$14 in mileage charges plus the \$3.50 flat fee. A common slip is to read $C(7)$ as "cost is \$7"; the input is miles, not dollars.

22. Keep the rule visible: $h(2)=-16(4)+48(2)+5=-64+96+5=37$ feet. Two seconds after the throw, the ball is 37 feet above the ground. The initial height was $h(0)=5$ feet, so in two seconds the ball climbed 32 feet net. That gives a quick check on the answer.

23. Set $P(t)=42$: $0.05t+25=42$, so $0.05t=17$, giving $t=\dfrac{17}{0.05}=340$ minutes. Check: $0.05(340)+25=17+25=42$. (A whole-minute count makes sense for a phone bill — no awkward fraction of a minute.)

24. Compute each side carefully. $f(1+3)=f(4)=16-16+7=7$. Now $f(1)=1-4+7=4$ and $f(3)=9-12+7=4$, so $f(1)+f(3)=8$. $7\neq 8$. Function notation *does not* distribute over addition: $f(a+b)\neq f(a)+f(b)$ except for very special functions like the identity $f(x)=x$.

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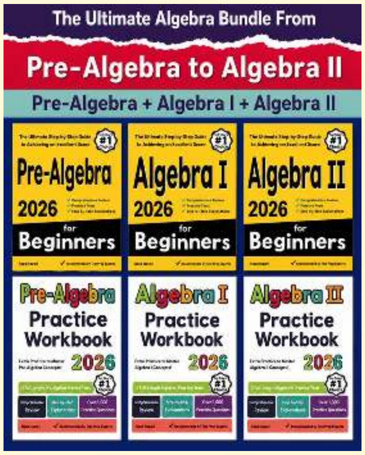

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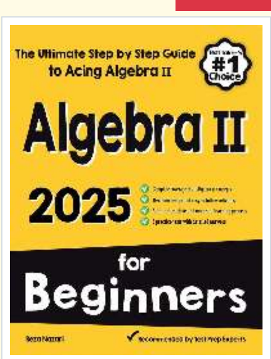

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