Combining Functions

Name: _____ Date: _____ Score: _____ / 26

Quick Review

Functions can be combined just like numbers: **add** $(f+g)(x)=f(x)+g(x)$; **subtract** $(f-g)(x)=f(x)-g(x)$; **multiply** $(f\cdot g)(x)=f(x)\cdot g(x)$; **divide** $\left(\frac{f}{g}\right)(x)=\frac{f(x)}{g(x)}$ (as long as $g(x)\neq 0$). After combining the expressions, simplify — combine like terms, factor when possible. For division, the domain excludes any x that makes the denominator zero. To evaluate a combination at a number, you can either combine first and then substitute, or substitute into each function first and then combine. Either way works.

PRACTICE

Let f(x)=2x+5 and g(x)=x^2-1 unless stated otherwise.

1. $(f+g)(x)$ _____
2. $(f-g)(x)$ _____
3. $(f\cdot g)(1)$ _____
4. $\left(\frac{g}{f}\right)(x)$ _____
5. $(f+g)(0)$ _____
6. $(f-g)(3)$ _____
7. $(g\cdot f)(-1)$ _____
8. Domain of $\frac{f}{g}$ _____
9. $h(x)=x,\ k(x)=4x-3;\ (h+k)(2)$ _____
10. $h(x)=x+1,\ k(x)=x-1;\ (h\cdot k)(x)$ _____
11. $p(x)=6x,\ q(x)=3;\ \left(\frac{p}{q}\right)(x)$ _____
12. $p(x)=x^2+x,\ q(x)=x;\ \left(\frac{p}{q}\right)(x)$ _____
13. $f(x)=3,\ g(x)=x;\ (f+g)(5)$ _____
14. $f(x)=x^2,\ g(x)=x;\ (f-g)(4)$ _____
15. $(f\cdot g)(0)$ _____
16. $(2f)(x)$ _____
17. $(f+g)(-2)$ _____
18. $\left(\frac{f}{f}\right)(x)\ (x\neq -\frac{5}{2})$ _____
19. $h(x)=2x,\ k(x)=3x;\ (h+k)(x)$ _____
20. $f(x)=x+2,\ g(x)=x-2;\ (f\cdot g)(x)$ _____

VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Use the tables to find $f(g(2))$.

x	1	2	3
$g(x)$	3	1	2
$f(x)$	4	7	9

Answer: _____

22. Use the tables to find $(f+g)(2)$.

x	1	2	3
$f(x)$	4	6	8
$g(x)$	3	5	7

Answer: _____

Word Problems

23. A store's revenue is $R(x)=12x$ and cost is $C(x)=5x+200$. Write profit $P=R-C$ and find break-even ($P=0$). _____

24. A rectangular poster has area $A(x)=x(x+4)$. A border adds 2 inches to every side, so the new area is $B(x)=(x+4)(x+8)$. Find $(B-A)(3)$ and interpret it. _____

25. A truck's fuel is $F(t)=20-2t$ gallons after t hours. Cost per gallon is $C=4$. Write total spent so far $S(t)=4\cdot(20-F(t))$. Find $S(5)$. _____

26. Person A walks at 3 mph, B at 4 mph. Write distance functions $D_A(t)=3t$ and $D_B(t)=4t$, then find the gap $(D_B-D$ 2 hours. _____

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Answer Keys

1. $x^2 + 2x + 4$
2. $-x^2 + 2x + 6$
3. 0
4. $\frac{x^2-1}{2x+5}$
5. 4
6. 3
7. 0
8. $x \neq \pm 1$
9. 7
10. $x^2 - 1$
11. $2x$
12. $x + 1\ (x \neq 0)$
13. 8
14. 12
15. -5
16. $4x + 10$
17. 4
18. 1
19. $5x$
20. $x^2 - 4$
21. 4
22. 11
23. $P(x) = 7x - 200;\ x \approx 28.6$
24. 56
25. $\$40$
26. 2 miles

Step-by-Step Tutor Notes

1. Focus on the main idea of the problem, then simplify carefully. $(2x + 5) + (x^2 - 1) = x^2 + 2x + 4$. So the answer is $x^2 + 2x + 4$.
2. $(2x + 5) - (x^2 - 1) = 2x + 5 - x^2 + 1 = -x^2 + 2x + 6$. (The minus flips the signs inside $(x^2 - 1)$.).
3. First identify the feature of the graph or equation that matches the wording of the question. $f(1) = 7$, $g(1) = 0$. Product: 0. (Anything times zero is zero.). That leads to 0.
4. Start with the definition the problem is testing, then apply it directly. Just write the ratio: $\frac{x^2-1}{2x+5}$. Domain excludes $x = -\frac{5}{2}$. So the answer is $\frac{x^2-1}{2x+5}$.
5. This is a good place to slow down, check the notation, and simplify cleanly. $f(0) = 5$, $g(0) = -1$. Sum: $5 + (-1) = 4$. So the answer is 4.
6. Focus on the main idea of the problem, then simplify carefully. $f(3) = 11$, $g(3) = 8$. Difference: $11 - 8 = 3$. So the answer is 3.
7. $g(-1) = 0$, $f(-1) = 3$. Product: $0 \cdot 3 = 0$. (Same as $f \cdot g$ — multiplication is commutative.).
8. Focus on the main idea of the problem, then simplify carefully. $g(x) = x^2 - 1 = 0$ when $x = \pm 1$. Exclude those. So the answer is $x \neq \pm 1$.
9. This is a good place to slow down, check the notation, and simplify cleanly. $h(2) = 2$, $k(2) = 5$. Sum: 7. So the answer is 7.
10. Focus on the main idea of the problem, then simplify carefully. $(x + 1)(x - 1) = x^2 - 1$ (difference of squares). So the answer is $x^2 - 1$.
11. Start with the definition the problem is testing, then apply it directly. $\frac{6x}{3} = 2x$. So the answer is $2x$.
12. Use the clue in the question first, then let the arithmetic finish the job. $\frac{x^2+x}{x} = \frac{x(x+1)}{x} = x + 1$ for $x \neq 0$. So the answer is $x + 1\ (x \neq 0)$.
13. This is a good place to slow down, check the notation, and simplify cleanly. $3 + 5 = 8$. So the answer is 8.
14. This is a good place to slow down, check the notation, and simplify cleanly. $f(4) = 16$, $g(4) = 4$. $16 - 4 = 12$. So the answer is 12.
15. This is a good place to slow down, check the notation, and simplify cleanly. $f(0) = 5$, $g(0) = -1$. Product: $5 \cdot (-1) = -5$. So the answer is -5.
16. Keep the order of operations in view, then simplify without skipping the sign check. Multiply f by 2: $2(2x + 5) = 4x + 10$. After simplifying, the answer is $4x + 10$.
17. This is a good place to slow down, check the notation, and simplify cleanly. $f(-2) = 1$, $g(-2) = 3$. Sum: 4. So the answer is 4.
18. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Any nonzero quantity divided by itself is 1. After simplifying, the answer is 1.
19. Use the clue in the question first, then let the arithmetic finish the job. $2x + 3x = 5x$ (combining like terms). So the answer is $5x$.
20. This is a good place to slow down, check the notation, and simplify cleanly. Difference of squares again: $(x + 2)(x - 2) = x^2 - 4$. So the answer is $x^2 - 4$.
21. This is a good place to slow down, check the notation, and simplify cleanly. First, $g(2) = 1$. Then use the table again: $f(1) = 4$. So the answer is 4.
22. Use the clue in the question first, then let the arithmetic finish the job. At $x = 2$, $f(2) = 6$ and $g(2) = 5$, so $(f + g)(2) = 11$. So the answer is 11.
23. $P(x) = 12x - (5x + 200) = 7x - 200$. Break-even: $7x - 200 = 0$, so $x = \frac{200}{7} \approx 28.6$ items. Round up to 29 to actually profit.
24. $(B - A)(x) = (x + 4)(x + 8) - x(x + 4)$. Factor out $(x + 4)$: $(x + 4)[(x + 8) - x] = (x + 4)(8) = 8(x + 4)$. At $x = 3$: $8(7) = 56$ square units.
25. Gallons used: $20 - F(t) = 20 - (20 - 2t) = 2t$. So $S(t) = 4(2t) = 8t$. At $t = 5$: $S(5) = 40$ dollars.
26. $D_B - D_A = 4t - 3t = t$. At $t = 2$: gap is 2 miles. (B walks 1 mph faster, so after 2 hours B is 2 miles ahead.).

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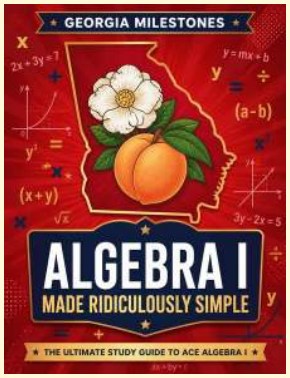

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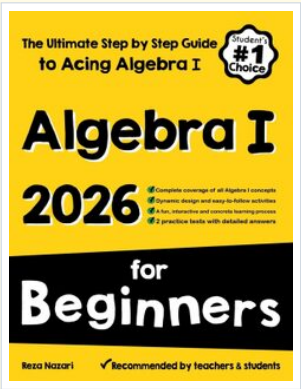

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