

Functions and Transformations: math test solutions, Grade 11 – download the PDF

Test solutions with the detailed point scale. Add up your points and spot what to review.

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Notation and domains

/ 3 pts

- a) $f(-2) = 2(4) + 2 + 3 = 13$. (1 pt)
- b) $2x - 7 \geq 0$ gives $x \geq 3.5$. (1 pt)
- c) $x^2 - 16 = 0$ for $x = \pm 4$, so the domain is all real numbers except 4 and -4 . (1 pt)

2 Transformations

/ 4 pts

- a) Shift 2 units left, vertical stretch by 3, reflection over the x-axis, shift 5 units up. (1 pt for the shifts, 1 pt for the stretch and reflection)
- b) The vertex is $(-2, 5)$. (1 pt)
- c) The graph opens downward from height 5: the range is $y \leq 5$. (0.5 pt)
- d) $g(1) = -3|3| + 5 = -9 + 5 = -4$. (0.5 pt)

3 Combining functions

/ 3 pts

- a) $(f + g)(x) = x^2 + 1 + 2x - 3 = x^2 + 2x - 2$. (1 pt)
- b) $f(2) = 5$ and $g(2) = 1$, so $(fg)(2) = 5$. (1 pt)
- c) $f(x) = x^2 + 1 \geq 1$, so it is never zero: the domain is all real numbers. (1 pt)

4 Composition

/ 4 pts

- a) $f(g(x)) = 3(x^2 - 1) + 2 = 3x^2 - 1$. (1 pt)
- b) $g(f(x)) = (3x + 2)^2 - 1 = 9x^2 + 12x + 3$. (1 pt)
- c) $f(g(-2)) = 3(4) - 1 = 11$. (1 pt)
- d) $3x^2 - 1 = 47$ gives $x^2 = 16$, so $x = 4$ or $x = -4$. (1 pt)

5 Inverse functions

/ 4 pts

- a) Swap: $x = (y - 2)^3 + 4$, so $(y - 2)^3 = x - 4$ and $y = \sqrt[3]{x - 4} + 2$. (2 pts)
- b) $f^{-1}(-4) = \sqrt[3]{-8} + 2 = 0$. Check: $f(0) = (-2)^3 + 4 = -4$. (1 pt)
- c) $f(f^{-1}(x)) = \left(\sqrt[3]{x - 4} + 2 - 2\right)^3 + 4 = (x - 4) + 4 = x$. (1 pt)

6 Shipping cost

/ 2 pts

- $1.2 \leq 2$: $S(1.2) = 6$. (1 pt)
- $6 > 2$: $S(6) = 6 + 2.5(4) = 16$. The shipping costs \$16. (1 pt)



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