

Building Functions from Real Situations

Grade 9 – Algebra 1 math · Worksheet Answer Key · Standards: F-BF.A.1a, F-BF.A.1b, F-BF.B.4a, F-LE.A.1b

Each answer builds the rule step by step and checks it with a value, with the final result in bold. For inverses, solve for the input variable and verify with one number. Profit problems use revenue minus cost.

Standards: F-BF.A.1a, F-BF.A.1b, F-BF.B.4a, F-LE.A.1b · **Level:** Grade 9 Algebra 1

Problem 1 Gym Membership Rule

Fixed fee plus rate times months: $M(t) = 30 + 18t$. $M(6) = 30 + 108 = 138$.

$M(t) = 30 + 18t$; \$138

Problem 2 Rising Pool Level

Recursive: $D(0) = 12$ and $D(n) = D(n - 1) + 2.5$. Explicit: $D(n) = 12 + 2.5n$.

$D(3) = 12 + 7.5 = 19.5$, matching the last bar.

$D(n) = 12 + 2.5n$; 19.5 inches

Problem 3 Steps to a Taxi Fare

$C(m) = 2.75m + 4$. $C(8) = 22 + 4 = 26$.

$C(m) = 2.75m + 4$; \$26

Problem 4 Constant Rate in a Table

Each step of 2 in x adds 6 to y , so the rate is $6 \div 2 = 3$ per unit. The value at $x = 0$ is 5.

$y = 3x + 5$

Problem 5 Add Two Functions

$(f + g)(x) = 5x - 3 + x^2 + 4 = x^2 + 5x + 1$. At $x = 3$: $9 + 15 + 1 = 25$.

Check: $f(3) = 12$, $g(3) = 13$, and $12 + 13 = 25$ ✓.

$$x^2 + 5x + 1; 25$$

Problem 6 Subtract Two Functions

$$(f - g)(x) = 5x - 3 - (x^2 + 4) = -x^2 + 5x - 7. \text{ At } x = 3: -9 + 15 - 7 = -1.$$

$$\text{Check: } f(3) - g(3) = 12 - 13 = -1 \checkmark.$$

$$-x^2 + 5x - 7; -1$$

Problem 7 Multiply Two Functions

$$(x + 7)(2x - 5) = 2x^2 - 5x + 14x - 35 = 2x^2 + 9x - 35.$$

$$\text{At } x = 2: 8 + 18 - 35 = -9. \text{ Check: } f(2) \cdot g(2) = 9 \cdot (-1) = -9 \checkmark.$$

$$2x^2 + 9x - 35; -9$$

Problem 8 Profit from Revenue and Cost

$$P(x) = 14x - (210 + 6x) = 8x - 210. P(40) = 320 - 210 = 110.$$

Profit needs $8x > 210$, so $x > 26.25$. At $x = 26$ profit is -2 and at $x = 27$ it is 6 .

$$P(x) = 8x - 210; \$110; 27 \text{ hoodies}$$

Problem 9 Inverse of a Linear Function

$$y = 4x - 7, \text{ so } 4x = y + 7 \text{ and } x = \frac{(y + 7)}{4}. \text{ So } f^{-1}(x) = \frac{(x + 7)}{4}.$$

$$\text{Check: } f(2) = 1 \text{ and } f^{-1}(1) = \frac{8}{4} = 2 \checkmark.$$

$$f^{-1}(x) = \frac{(x + 7)}{4}$$

Problem 10 Inverse with a Negative Slope

$$y = -2x + 10, \text{ so } 2x = 10 - y \text{ and } x = \frac{(10 - y)}{2}.$$

$$f^{-1}(x) = \frac{(10 - x)}{2} = 5 - \frac{x}{2}. \text{ Check: } f(1) = 8 \text{ and } f^{-1}(8) = \frac{2}{2} = 1 \checkmark.$$

$$f^{-1}(x) = \frac{(10 - x)}{2}$$

Problem 11 Solve $f(x) = c$

$5x + 12 = 47$, so $5x = 35$ and $x = 7$.

Check: $f(7) = 35 + 12 = 47 \checkmark$.

$x = 7$

Problem 12 Convert Temperatures

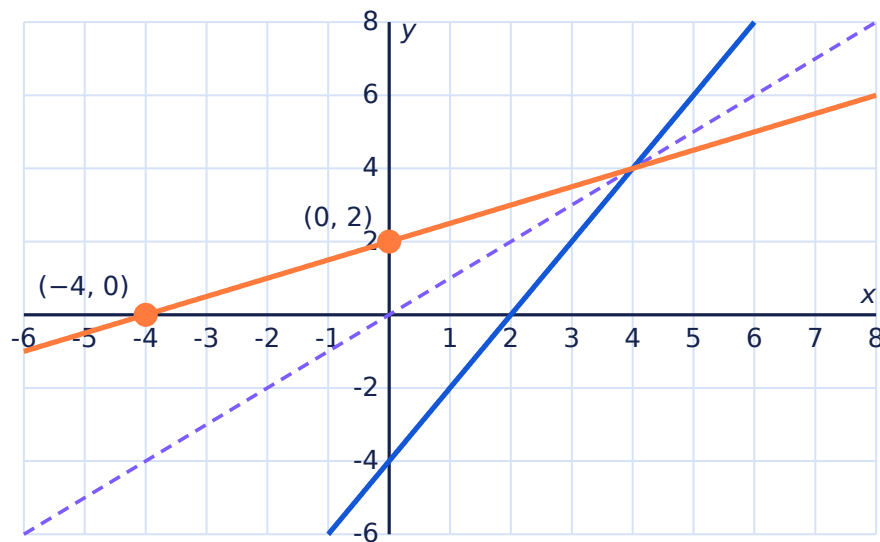
$F - 32 = \frac{9}{5}C$, so $C = \frac{5}{9}(F - 32)$.

77°F : $\frac{5}{9}(45) = 25$. 14°F : $\frac{5}{9}(-18) = -10$.

$C = \frac{5}{9}(F - 32)$; 25°C and -10°C

Problem 13 Reflect a Graph

An inverse swaps coordinates: $(0, -4) \rightarrow (-4, 0)$ and $(2, 0) \rightarrow (0, 2)$. The slope through them is $(2 - 0) \div (0 - (-4)) = \frac{1}{2}$, and the y-intercept is 2.



The inverse swaps x and y .

$(-4, 0)$ and $(0, 2)$; $f^{-1}(x) = \frac{x}{2} + 2$

Problem 14 Area and Perimeter Rules

Area: $(3x + 2)(x + 5) = 3x^2 + 15x + 2x + 10 = 3x^2 + 17x + 10$.

Perimeter: $2(3x + 2) + 2(x + 5) = 6x + 4 + 2x + 10 = 8x + 14$.

$$A(x) = 3x^2 + 17x + 10; P(x) = 8x + 14$$

Problem 15 Savings Plan, Recursive to Explicit

Each month adds 45, so $S(n) = 250 + 45n$.

Solve $250 + 45n \geq 1000$: $45n \geq 750$, so $n \geq 16.67$. At $n = 16$ the balance is 970; at $n = 17$ it is 1,015.

$$S(n) = 250 + 45n; \text{ month } 17$$

Problem 16 Unequal Steps, Same Rate

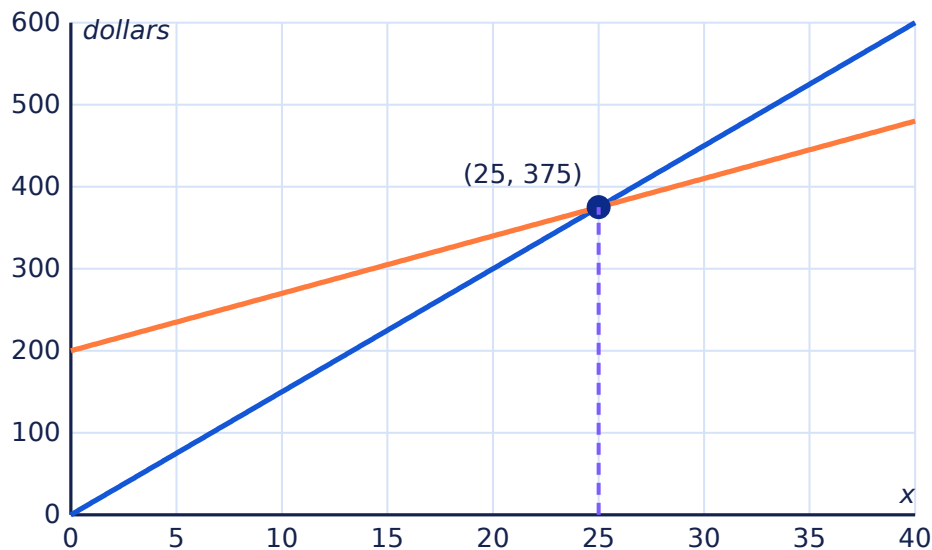
Rates: $(22 - 14) \div 2 = 4$, $(34 - 22) \div 3 = 4$, $(50 - 34) \div 4 = 4$. The rate is 4 per unit each time.

Use $y = 4x + b$ with $(1, 14)$: $14 = 4 + b$, so $b = 10$. Check $(10, 50)$: $40 + 10 = 50$ ✓.

$$y = 4x + 10$$

Problem 17 Break-Even Point

$P(x) = 15x - 200 - 7x = 8x - 200$. Break-even: $8x - 200 = 0$, so $x = 25$.



Break-even at 25 items.

$$P(40) = 320 - 200 = 120.$$

$$P(x) = 8x - 200; 25 \text{ keychains; } \$120$$

Problem 18 Inverse in Context

$C = 2.75m + 4$, so $m = \frac{(C - 4)}{2.75}$. This is the inverse function.

For \$26: $22 \div 2.75 = 8$ miles. For \$15: $11 \div 2.75 = 4$ miles.

$m = \frac{(C - 4)}{2.75}$; 8 miles and 4 miles

Problem 19 Discount Then Shipping

$T(p) = 0.85p + 8$. Solve $T = 0.85p + 8$: $p = \frac{(T - 8)}{0.85}$.

For $T = 110$: $102 \div 0.85 = 120$. Check: $0.85(120) + 8 = 110$ ✓.

$T(p) = 0.85p + 8$; the item costs \$120

Problem 20 Fill and Leak

$V(t) = 20 + 8t - 3t = 20 + 5t$.

Solve $20 + 5t = 100$: $5t = 80$, so $t = 16$.

$V(t) = 20 + 5t$; after 16 hours