

Introduction to Functions Review

Try each problem first. You don't need to finish everything.

Core path ~55 min · Full sheet ~1 h 50 min

Recommended: K1-K5, then one A and one T problem

K = Knowledge & Understanding · A = Application · T = Thinking · Boss = Challenge



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QUICK REFERENCE

Function: every input has exactly one output. On a graph, every vertical line meets the curve at most once.

Inverse: swap x and y , then solve for y . The domain of f^{-1} is the range of f .

Show your work on separate paper.

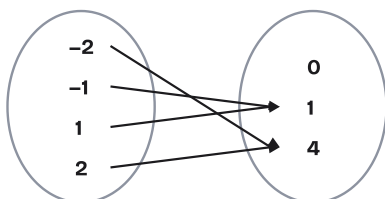
Core Skills (K)

Relations · Notation · Parent Functions · Domain & Range · Inverses

K1 Function or Not?

For each relation, state its domain and range, then decide whether it is a function. If it is not, name one input that has two outputs.

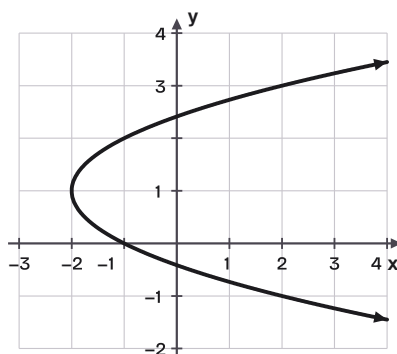
a) The mapping diagram.



b) The table of values.

x	3	5	3	7
y	1	2	4	2

c) The graph. Each grid square is 1 unit.



K2 Function Notation

Let $f(x) = x^2 - 2x - 3$.

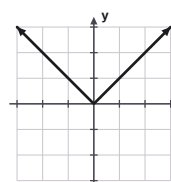
- Evaluate $f(-2)$.
- Simplify $f(x + 1)$.
- Simplify $f(x) + 1$.

Interval notation: a square bracket includes the endpoint, a round bracket excludes it, and $\pm\infty$ always gets a round bracket.

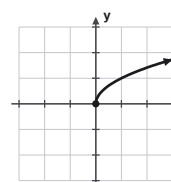
$f^{-1}(x)$ is the inverse of f . It is **not** $\frac{1}{f(x)}$.

K3 Parent Functions

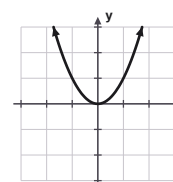
Graphs A to D show $y = x^2$, $y = \sqrt{x}$, $y = \frac{1}{x}$ and $y = |x|$, in some order. Each grid square is 1 unit.



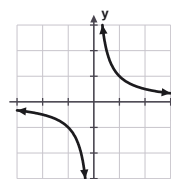
Graph A



Graph B



Graph C



Graph D

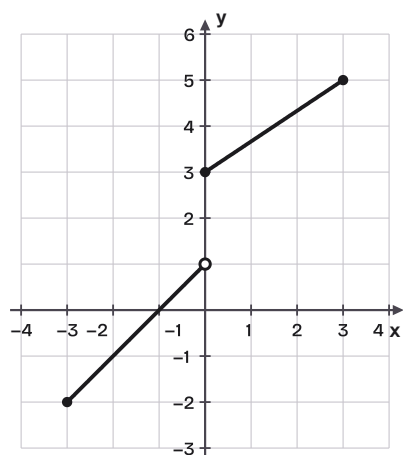
- Match each graph to its equation.
- State the domain and range of each function in interval notation.
- $y = x^2$ and $y = |x|$ have the same domain and range. Evaluate both at $x = 3$ and at $x = \frac{1}{2}$.

K4 Domain & Range

State the domain and range of each function in interval notation.

- $f(x) = \sqrt{10 - 2x}$
- $g(x) = \frac{3}{x + 4} - 1$

- c) The function graphed below. Each grid square is 1 unit.



K5 Inverses

- a) Determine $f^{-1}(x)$ for $f(x) = \frac{2x+1}{5}$.
- b) Evaluate $f^{-1}(3)$ and $\frac{1}{f(3)}$.
- c) For $q(x) = \sqrt{x+3}$, determine $q^{-1}(x)$ and state its domain and range.

Real World (A)

Domain & Range in Context · Inverses in Context

A1 Balcony Toss

A ball is tossed upward from a balcony. Its height above the ground, in metres, after t seconds is

$$h(t) = -5t^2 + 15t + 20.$$

- a) Find when the ball hits the ground. Then state the domain and range of h in this context.
- b) Solve $h(t) = 20$. What does each solution mean for the ball?
- c) The formula also gives $h(-1) = 0$. What, if anything, does this tell you about the ball?

A2 Celsius to Fahrenheit

The function $F(c) = 1.8c + 32$ converts a temperature of c °C into degrees Fahrenheit.

- a) Determine $F^{-1}(x)$. What do its input and its output represent?
- b) A weather app shows 86 °F for Orlando. Use F^{-1} to convert it to Celsius.
- c) Nothing can be colder than absolute zero, -273.15 °C. State the realistic domain and range of F . Then evaluate $F^{-1}(-500)$ and say what the result means.

A3 Parking Cap

A downtown parking lot charges \$4 per hour, charged for the exact time parked, up to a daily maximum of \$20. Let $C(h)$ be the cost, in dollars, of parking for h hours, where $0 \leq h \leq 24$.

- a) Write $C(h)$ as a piecewise function and state its range.
- b) You paid \$14. How long did you park?
- c) Your friend paid \$20. Can you tell how long they parked? Explain using the inverse of C .

Think It Through (T)

Error Analysis · Building Functions

T1 Spot the Flaw

A student finds the inverse of $f(x) = (x+2)^2 - 1$:

"Swap x and y : $x = (y+2)^2 - 1$, so $x+1 = (y+2)^2$ and $y+2 = \sqrt{x+1}$. Therefore $f^{-1}(x) = \sqrt{x+1} - 2$, and f^{-1} is a function."

- a) Find two different inputs that f sends to 3. What does this mean for the inverse at 3?
- b) Identify the step where the student lost a solution, and correct it.
- c) Restrict the domain of f so that the student's formula is correct. Then give the other restriction and its inverse formula.

T2 Build It Backwards

Write the equation of a function with each property. Many answers are possible.

- a) Domain $\{x \in \mathbb{R} \mid x \neq 3\}$ and range $\{y \in \mathbb{R} \mid y \neq -2\}$.
- b) Domain $(-\infty, 4]$ and range $[1, \infty)$.
- c) It is its own inverse, and it is not $y = x$. Show that $f(f(x)) = x$.

Boss Level

Optional challenge

A Function in Disguise

A function f satisfies $f(2x+1) = 4x^2 + 2x + 3$ for every real number x .

- a) Find $f(3)$ without finding a formula for f .
- b) Find a formula for $f(x)$.
- c) State the range of f . For which value of k does $f(x) = k$ have exactly one solution?



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