

Function Feature Faceoff

Compare what functions do, not just their names.

HIGH SCHOOL • MA.912.F.1.6

MA.912.F.1.6 "Compare key features of linear and nonlinear functions each represented algebraically, graphically, in tables or written descriptions."

NAME _____

DATE _____

COMPARE FEATURES AND EVIDENCE

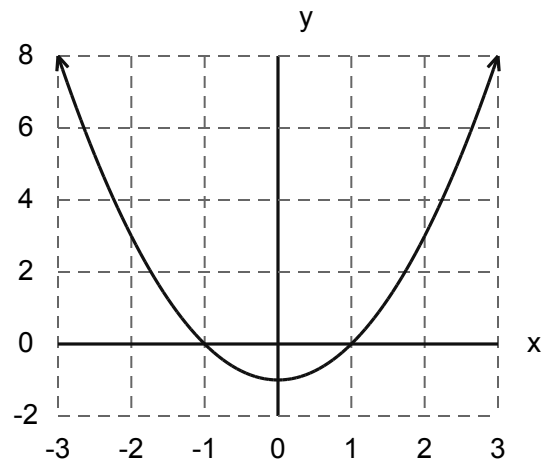
Compare domain, range, intercepts, signs and rising/falling intervals. An arrow continues the graph; a viewing window does not restrict its domain. End behavior describes far-left and far-right behavior. An asymptote is a line the graph approaches. A finite table establishes only its listed values unless a model is stated. Exponential growth eventually exceeds any fixed linear or quadratic growth model.

WORKED EXAMPLE

Compare $f(x)=x-1$ with the graph of $g(x)=x^2-1$. Both domains are all real numbers. Which has a minimum?

- Both have y-intercept -1. The line has x-intercept 1; the parabola has x-intercepts -1 and 1.
- The line rises everywhere and has all real outputs. The parabola falls for $x<0$, then rises for $x>0$.

Answer: Only g has a minimum: -1 at $x=0$. Its range is $[-1, \infty)$; f has no minimum.



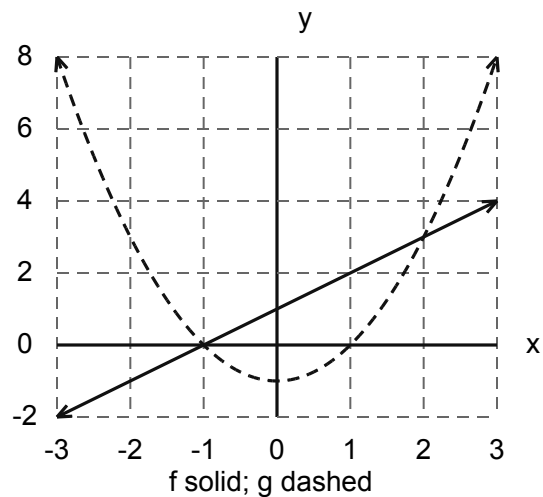
PRACTICE 4 problems

- 1** Only these four values of A are known. B is a line rising 3 units for every 1-unit increase in x, with $B(0)=2$. Compare A and B at the listed inputs. Can you conclude that A is linear or that $A(4)=14$? Explain.

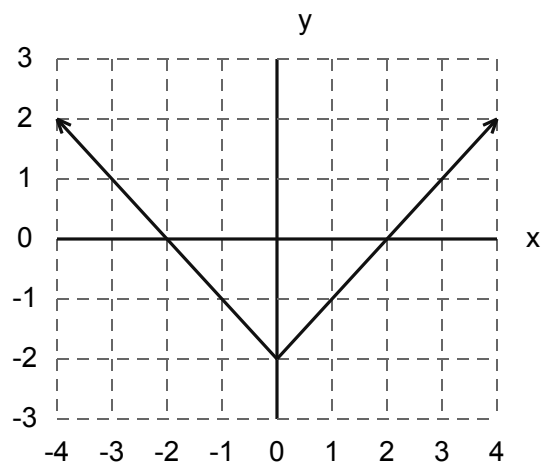
KNOWN VALUES OF A

x	A(x)
0	2
1	5
2	8
3	11

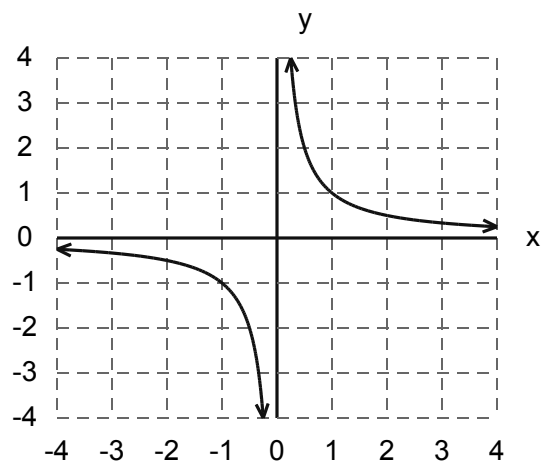
- 2** Compare f and g , shown on the same scales. Give each domain, range and intercepts. Where is each positive? State its increasing and decreasing intervals.



- 3** The graph is $g(x)=|x|-2$ on all real x . Compare its end behavior and negative-output interval with $f(x)=x-2$. Identify their shared intercept and explain one difference in range.



- 4** The graph is $r(x)=1/x$. Compare its domain, range, intercepts and asymptotes with the line $L(x)=x$. How do their positive- x end behaviors differ?



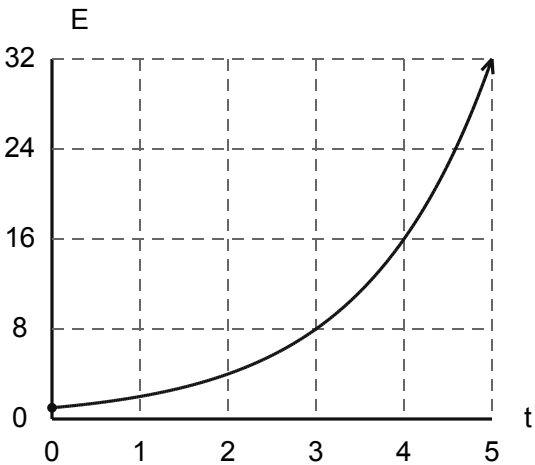
APPLY IT Show your work

- 1** A square plot has area $A(s)=s^2$. A rectangle with width 3 m has area $B(s)=3s$; both lengths s may be any real value from 0 to 4 m. Find both ranges and all lengths where the areas agree. Which is larger for $0<s<3$ and $3<s\leq 4$?

SQUARE AREA

s (m)	A (square m)
0	0
1	1
2	4
3	9
4	16

- 2** Two continuous growth models start at 1 unit: $E(t)=2^t$ is graphed and $L(t)=4t+1$, $t\geq 0$. At $t=4$ and 5 compare their values. Which eventually grows faster? Does L staying ahead through $t=4$ prove it always wins?



CHALLENGE One step up

Compare $E(x)=2^x$, $Q(x)=x^2$ and $L(x)=4x+1$ for $x \geq 0$. Use the table to identify ties and leaders at the listed inputs. Does it prove E is greatest for EVERY $x > 8$? Separate finite-table evidence from the stated exponential-growth principle.

THREE EXPLICIT MODELS

x	E(x)	Q(x)	L(x)
0	1	0	1
2	4	4	9
4	16	16	17
6	64	36	25
8	256	64	33

WORK SPACE AND ANSWER

PRACTICE 1

$B(x)=3x+2$, so all four listed values agree. No: a finite table does not establish A between or beyond those inputs, or prove $A(4)=14$.

PRACTICE 2

$f=x+1$: domain/range all real; intercepts $(-1,0),(0,1)$; positive $x>-1$; increasing everywhere. $g=x^2-1$: domain all real, range $[-1,\infty)$; intercepts $(-1,0),(1,0),(0,-1)$; positive $x<-1$ or $x>1$; decreases $x<0$, increases $x>0$.

PRACTICE 3

Both are negative on $0<x<2$, but f is negative for all $x<2$ and g only for $-2<x<2$. Both have y -intercept -2 and x -intercept 2 . f goes to negative infinity on the left and positive infinity on the right; g goes to positive infinity at both ends. f has all real outputs; g has range $[-2,\infty)$.

PRACTICE 4

r excludes 0 from domain and range; no intercepts; asymptotes $x=0$ and $y=0$. L has all-real domain/range and intercept $(0,0)$; no asymptotes. As x grows positive, r approaches 0 from above, while L grows without bound.

APPLY IT 1

Ranges: $A [0,16]$, $B [0,12]$ square meters. $s^2=3s$ gives $s=0$ or 3 m. B is larger for $0<s<3$; A for $3<s\leq 4$. The explicit formulas justify the intervals, not only the table.

Factor $s(s-3)=0$. Compare $A-B=s(s-3)$ on the stated domain.

APPLY IT 2

At 4 : $E=16$, $L=17$; at 5 : $E=32$, $L=21$. E has overtaken L and eventually grows faster. Early data do not prove a permanent ordering; E doubles each unit while L adds 4 .

Use the formulas for exact values; the graph shows exponential curvature.

CHALLENGE

At 0 : $E=L=1>Q$. At 2 : $L=9>E=Q=4$. At 4 : $L=17>E=Q=16$. At 6 and 8 : $E>Q>L$. The table alone proves nothing for unlisted $x>8$. The growth principle says E eventually exceeds both forever, without establishing the exact threshold from this table.

Accept interval descriptions in words or symbols. Positive/negative intervals exclude zeros. Distinguish both shared intercepts in the absolute-value comparison. Finite samples do not establish global behavior; formulas and the stated growth principle provide additional information.