LESSON MAKER PRO

Where Curves Meet

Estimate solutions from tables and graphs

HIGH SCHOOL · A2S.AF.E.14.a

A2S.AF.E.14.a "Find the approximate solutions of an equation graphically, using tables of values, or finding successive approximations, using technology where appropriate. Extend to cases where f(x) and/or g(x) are polynomial..."

NAME _____ DATE _____

BRACKET AND ESTIMATE

When a function is below a target at one x-value and above it at another, a solution lies between those values if the function is continuous there. Use the midpoint of the interval for a first estimate. On a graph, solutions are the x-values where the graphs meet.

WORKED EXAMPLE

Use the table to estimate the positive solution of $x^2 = 70$. Give an interval and its midpoint.

VALUES OF X SQUARED

x	x^2
8.3	68.89
8.4	70.56

1. 68.89 is below 70, and 70.56 is above 70.
2. The solution lies between 8.3 and 8.4.
3. The midpoint is (8.3 + 8.4)/2 = 8.35.

Answer: 8.3 < x < 8.4; midpoint estimate: 8.35

PRACTICE 6 problems

1 Use the table to bracket the positive solution of $x^2 = 3$. Give the interval and its midpoint.

VALUES OF X SQUARED

x	x^2
1.7	2.89
1.8	3.24

ANSWER _____

2 Use the table to bracket the solution of $\sqrt{x} = 2.5$. Give the interval and its midpoint.

VALUES OF SQUARE ROOT OF X

x	$\sqrt{x}$
6.2	2.490
6.3	2.510

ANSWER _____

3 Use the table to bracket the solution of $\sin(x) = 0.35$, where x is in degrees. Give the interval and its midpoint.

SINE VALUES

x (degrees)	sin(x)
20	0.342
21	0.358

ANSWER _____

4 Use the table to bracket the solution of $\log_{10}(x) = 0.4$. Give the interval and its midpoint.

LOGARITHM VALUES

x	$\log_{10}(x)$
2.5	0.398
2.6	0.415

ANSWER _____

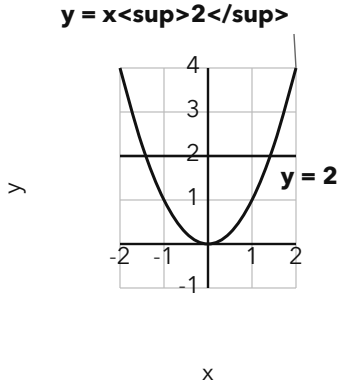
5 For $x < 4$, $f(x) = x - 1$. For $x \geq 4$, $f(x) = 2x - 6$. Use the table to bracket a solution of $f(x) = 1.5$. Give the interval and its midpoint.

VALUES OF F

x	f(x)
2.4	1.4
2.6	1.6
4.0	2.0

ANSWER _____

6 Use the graph to estimate both solutions of $x^2 = 2$ to the nearest tenth.



ANSWER _____

APPLY IT Show your work

1 A basketball's height h, in feet, after t seconds is $h(t) = -t^2 + 5t + 6$. Use the table to estimate when the rising ball first reaches 9 feet. Give an interval and its midpoint.

BASKETBALL HEIGHT

t (seconds)	h(t) (feet)
0.6	8.64
0.8	9.36

ANSWER _____

2 A phone's battery charge B, as a percent, is modeled by $B(t) = 100 - t^2$ for the first 10 hours of use. Use the table to estimate when the charge reaches 50%. Give an interval and its midpoint.

BATTERY CHARGE

t (hours)	B(t) (%)
7.0	51
7.2	48.16

ANSWER _____

CHALLENGE One step up

Use both rounds of the table to bracket the positive solution of $x^2 = 5$. Give the narrower interval and its midpoint. Explain in one sentence why this estimate is an improvement.

TWO ROUNDS OF VALUES

First x	x^2	Refined x	x^2
2.2	4.84	2.23	4.9729
2.3	5.29	2.24	5.0176

WORK SPACE AND ANSWER

Where Curves Meet

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the table to bracket the positive solution of $x^2 = 3$. Give the interval and its midpoint.	**1.7 < x < 1.8; midpoint estimate: 1.75**
2	Use the table to bracket the solution of $\sqrt{x} = 2.5$. Give the interval and its midpoint.	**6.2 < x < 6.3; midpoint estimate: 6.25**
3	Use the table to bracket the solution of $\sin(x) = 0.35$, where x is in degrees. Give the interval and its midpoint.	**20° < x < 21°; midpoint estimate: 20.5°**
4	Use the table to bracket the solution of $\log_{10}(x) = 0.4$. Give the interval and its midpoint.	**2.5 < x < 2.6; midpoint estimate: 2.55**
5	For $x < 4$, $f(x) = x - 1$. For $x \geq 4$, $f(x) = 2x - 6$. Use the table to bracket a solution of $f(x) = 1.5$. Give the interval and its midpoint.	**2.4 < x < 2.6; midpoint estimate: 2.5**
6	Use the graph to estimate both solutions of $x^2 = 2$ to the nearest tenth.	**$x \approx -1.4$ and $x \approx 1.4$**

PART 2 · APPLY IT

1. **0.6 < t < 0.8 seconds; midpoint estimate: 0.7 seconds** The height changes from below 9 feet to above 9 feet between 0.6 and 0.8 seconds. Their midpoint is 0.7 seconds.
2. **7.0 < t < 7.2 hours; midpoint estimate: 7.1 hours** The charge falls through 50% between 7.0 and 7.2 hours. Their midpoint is 7.1 hours.

CHALLENGE

2.23 < x < 2.24; midpoint estimate: 2.235. The refined interval is narrower, so its midpoint is closer to the solution than the first interval's midpoint.

Accept equivalent interval notation. Values in the radical, sine, and logarithm tables are rounded; students should use the supplied values to bracket each solution.