

Exponential Data Detectives

Find a growth or decay model, then use it to make predictions.

HIGH SCHOOL • MA.912.DP.2.9

MA.912.DP.2.9 "Fit an exponential function to bivariate numerical data that suggests an exponential association. Use the model to solve real-world problems in terms of the context of the data."

NAME _____

DATE _____

SPOT THE MULTIPLIER

Exponential data have equal multiplicative changes in y for equal changes in x . If y is multiplied by r whenever x increases by one unit, use $y=a*r^x$, where a is the y -value at $x=0$. If your table starts at another x -value, use $y=y_0*r^{(x-x_0)}$.

WORKED EXAMPLE

The table shows x : 40, 41, 42 and y : 13, 91, 637. Fit an exponential model.

1. The y -values have a constant ratio:
 $91/13=7$ and $637/91=7$.
2. At $x=40$, $y=13$, so use a shifted exponent that begins there.
3. Write $y=13*7^{(x-40)}$.

Answer: $y=13*7^{(x-40)}$

PRACTICE 6 problems

- 1** The data are x : 0, 1, 2 and y : 4, 8, 16. Write an exponential model in the form $y=a*b^x$.

ANSWER _____

- 2** The data are x : 1, 2, 3 and y : 81, 27, 9. Write an exponential model in the form $y=a*b^x$.

ANSWER _____

- 3** Use the model $y=6*2^x$. Find y when $x=4$.

ANSWER _____

- 4** The data are x : 2, 3, 4 and y : 5, 15, 45. Predict y when $x=5$.

ANSWER _____

- 5** Use the model $y=128*(1/2)^x$. Solve for x when $y=16$.

ANSWER _____

- 6** The data are x : 0, 1, 2, 3 and y : 100, 50, 25, 12.5. Does the data show an exponential association? If yes, write a model.

ANSWER _____

APPLY IT Show your work

- 1** A student's short video has 120 views after 0 days, 240 views after 1 day, and 480 views after 2 days. Let V be the number of views after t days. Fit an exponential model, then predict the number of views after 4 days.

WORK SPACE

ANSWER _____

- 2** A phone battery is at 96% after 0 hours, 48% after 2 hours, and 24% after 4 hours. Let B be the battery percentage after t hours. Fit an exponential model, then find when the battery will be at 6%.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A game server records x : 0, 2, 4 and y : 9, 36, 144. Fit an exponential model in the form $y = a \cdot b^x$. Then find y when $x = 5$ and explain why the base is not 4.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	The data are x: 0, 1, 2 and y: 4, 8, 16. Write an exponential model in the form $y=a*b^x$.	$y=4*2^x$
2	The data are x: 1, 2, 3 and y: 81, 27, 9. Write an exponential model in the form $y=a*b^x$.	$y=243*(1/3)^x$
3	Use the model $y=6*2^x$. Find y when $x=4$.	96
4	The data are x: 2, 3, 4 and y: 5, 15, 45. Predict y when $x=5$.	135
5	Use the model $y=128*(1/2)^x$. Solve for x when $y=16$.	$x=3$
6	The data are x: 0, 1, 2, 3 and y: 100, 50, 25, 12.5. Does the data show an exponential association? If yes, write a model.	Yes; $y=100*(1/2)^x$

PART 2 • APPLY IT

- $V=120*2^t$; 1,920 views after 4 days** The number of views is multiplied by 2 each day, so $V=120*2^t$. Substitute $t=4$ to get $V=120*16=1,920$.
- $B=96*(1/2)^{(t/2)}$; 8 hours** The battery is multiplied by $1/2$ every 2 hours, so $B=96*(1/2)^{(t/2)}$. At 8 hours, $B=96*(1/2)^4=6$.

CHALLENGE

$y=9*2^x$; when $x=5$, $y=288$. Every increase of 2 in x multiplies y by 4, so each increase of 1 in x multiplies y by 2.

Accept algebraically equivalent models that match every data value, including shifted-exponent forms. For prediction and solving items, accept exact equivalent numerical forms and correct context labels.