

Grade 8 - Using Linear Models to Predict - Lesson

Common Core 8.SP.A.3 · maths-pdf.fr/en/

A linear model is an equation $y = mx + b$ that fits a scatter plot. The slope m is the predicted change in y for each 1-unit change in x , and the intercept b is the predicted y when x is 0. Use it to predict by substituting x , or solve for x to find a target.

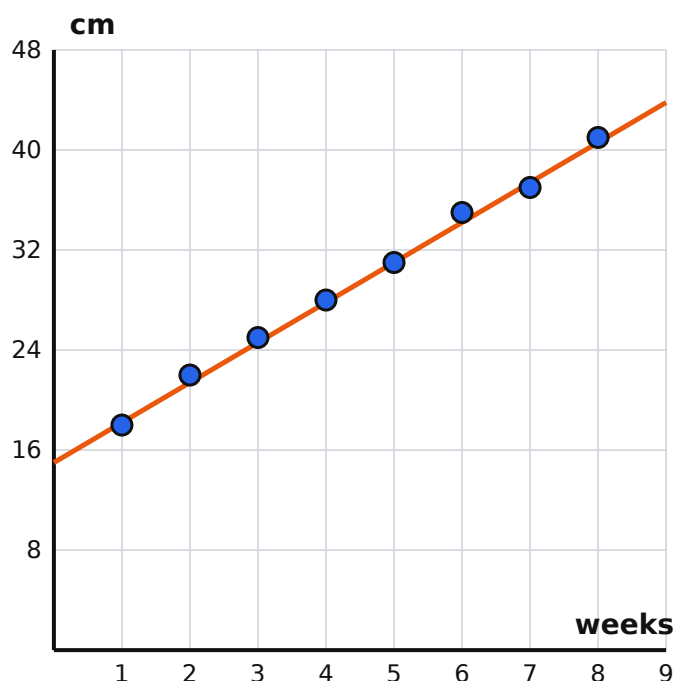
Grade 8 · Common Core State Standards: **8.SP.A.3**

Key facts

- Slope: the predicted change in y per 1-unit increase in x , with units.
- Intercept: the predicted y when $x = 0$, if that is meaningful.
- Find the equation from two points on the trend line.
- Predict by substituting x ; find x from a target y by solving an equation.
- Be cautious when predicting far outside the data range.

How do you interpret a linear model?

A trend line has an equation $y = mx + b$. In a data context, the **slope** m is the predicted change in y for each 1-unit increase in x . The **intercept** b is the predicted value of y when $x = 0$.

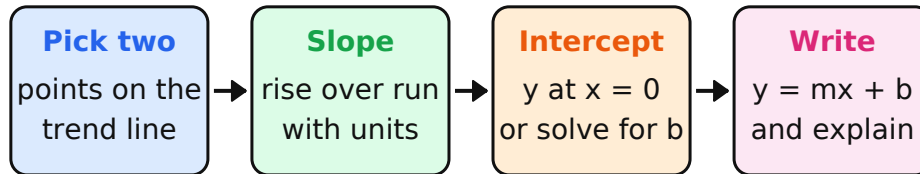


Height of a bean plant by week.

Meaning in context

For the plant model $y = 3.2x + 15$, where y is the height in cm after x weeks: the slope 3.2 means the plant grows about 3.2 cm per week, and the intercept 15 means the plant was about 15 cm tall at the start (week 0).

How do you build the equation from the graph?

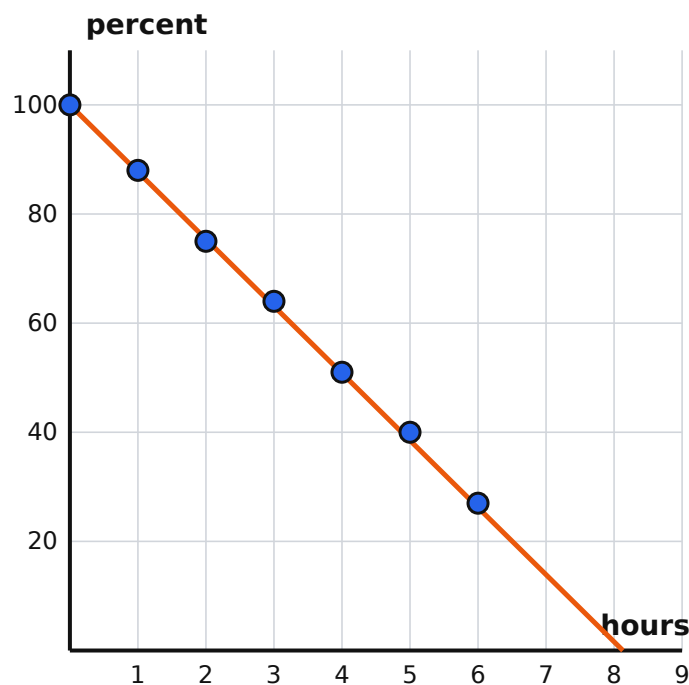


Steps for writing the model.

Worked example. A trend line passes through (2,25) and (8,55). The slope is $\frac{55-25}{8-2} = 5$. Then $25 = 5 \cdot 2 + b$, so $b = 15$, and $y = 5x + 15$.

How do you use the model to predict?

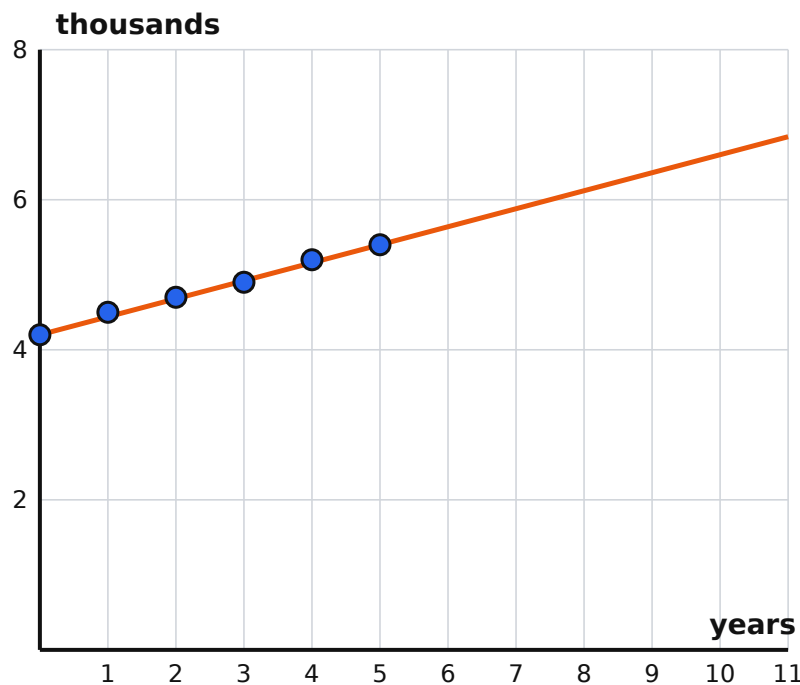
Substitute a value of x to predict y . For a plant at week 10, $y = 3.2 \cdot 10 + 15 = 47$ cm. To predict when a target is reached, set y to the target and solve for x .



Phone battery while streaming video.

A phone battery falls according to $y = -12.3x + 100$, where x is hours of video. At $x = 5$, the

model predicts $-12.3 \cdot 5 + 100 = 38.5$ percent. The battery is empty when $y = 0$: $x = \frac{100}{12.3} \approx 8.1$ hours.



Town population in thousands, with the trend line extended to year 10.

Be careful: predictions inside the range of your data (interpolation) are usually reliable. Predictions far outside the data (extrapolation) may not be, because the pattern might change. The intercept also may not make sense in every situation.

Questions about using linear models to predict

What does the slope of a trend line mean?

It is the predicted change in the y-variable for each 1-unit increase in the x-variable. For $y = 3.2x + 15$, the plant grows about 3.2 cm per week.

What does the y-intercept mean?

It is the predicted y-value when x is 0. Sometimes it has a real meaning, like a starting height, and sometimes it does not.

How do I use the line to predict?

Substitute the x-value into the equation and compute y. For example, at $x = 10$ the plant model gives $3.2 \cdot 10 + 15 = 47$.

What is extrapolation?

Using the model to predict outside the range of the data. It can be unreliable because the pattern may not continue.

Is the prediction exact?

No. A trend line describes the pattern, so real values will usually be a little above or below the prediction.