Probability & Statistics Notes

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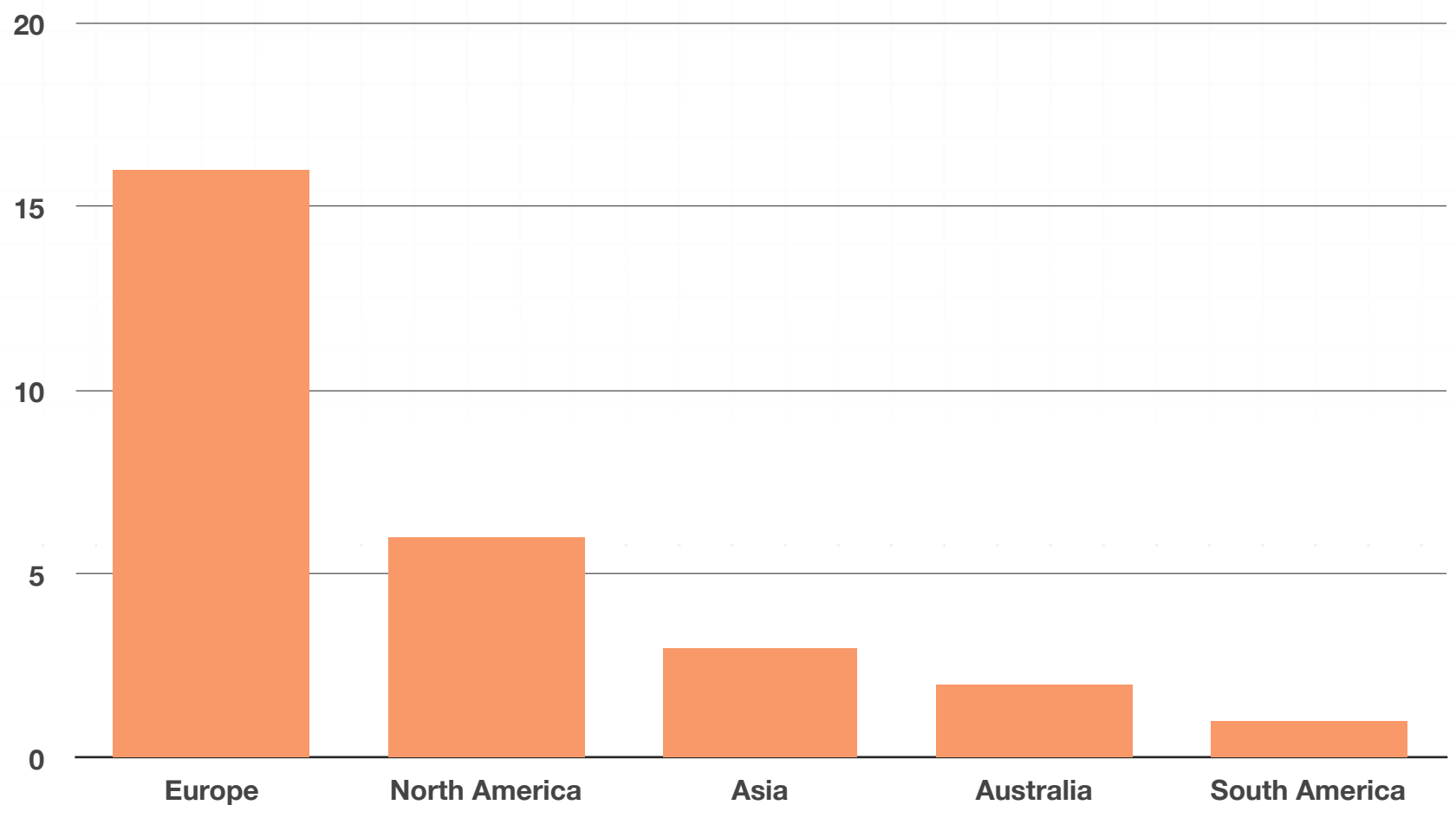
MATH

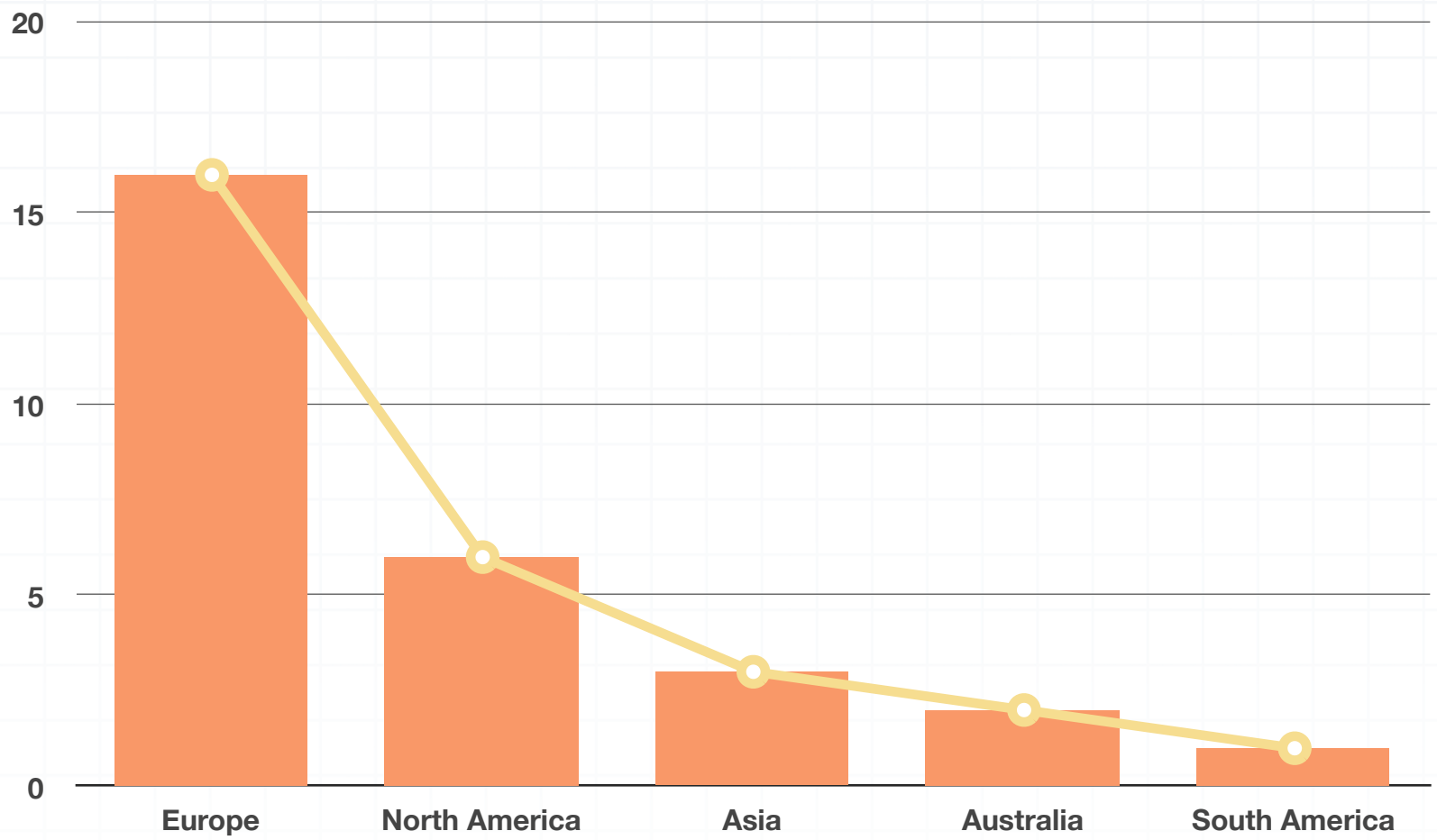
Line graphs and ogives

Line graphs are really similar to bar graphs. In fact, to turn a bar graph into a line graph, all you have to do is connect the middle of the top of each bar to the middle of the top of the bar beside it with a straight line, and you'll form the line graph.

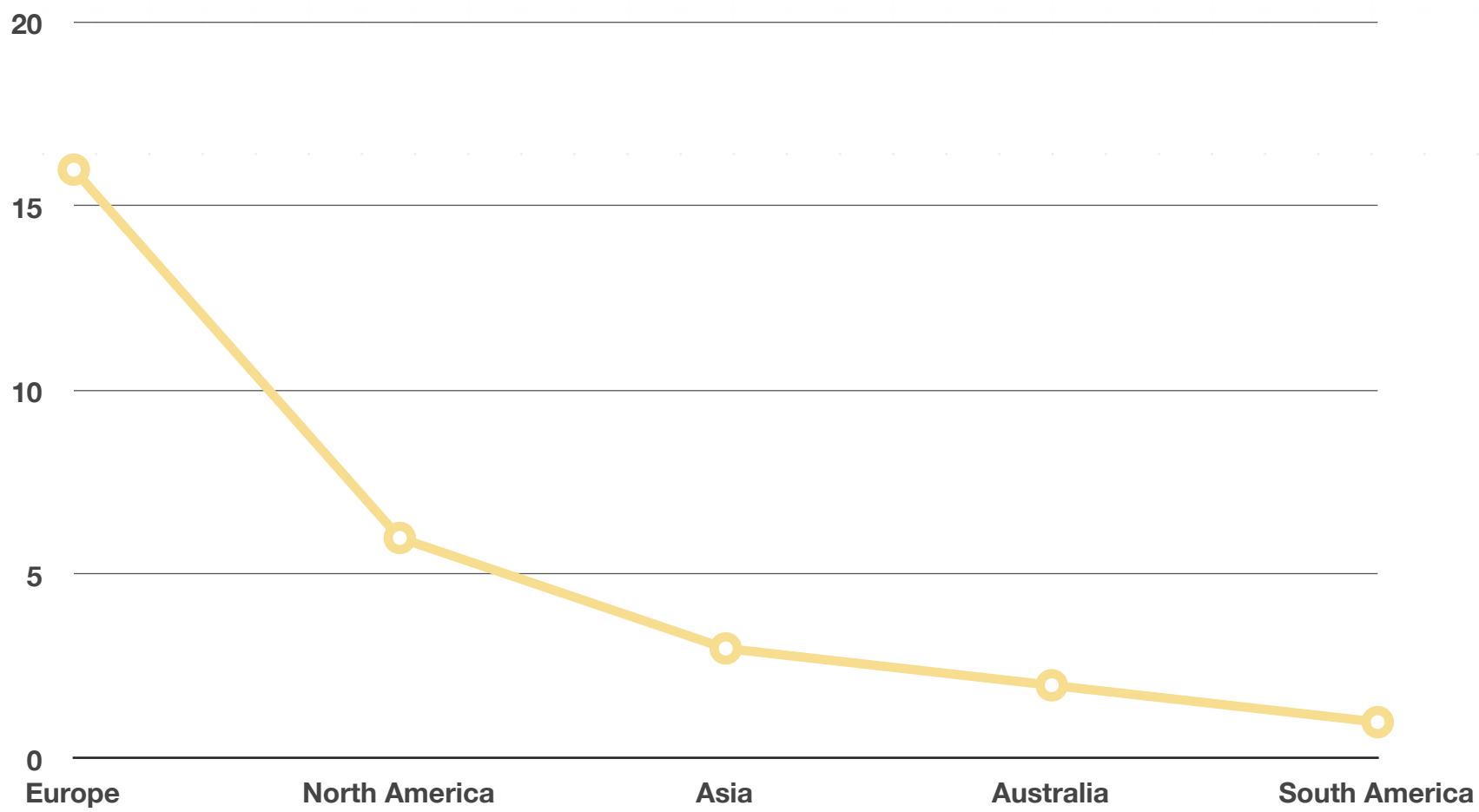
For example, we could take a bar graph for the summer Olympics from the previous section.



Then we can use straight lines to connect the top of each bar.



Then we can remove the bars, and we have a line graph that represents the same data.

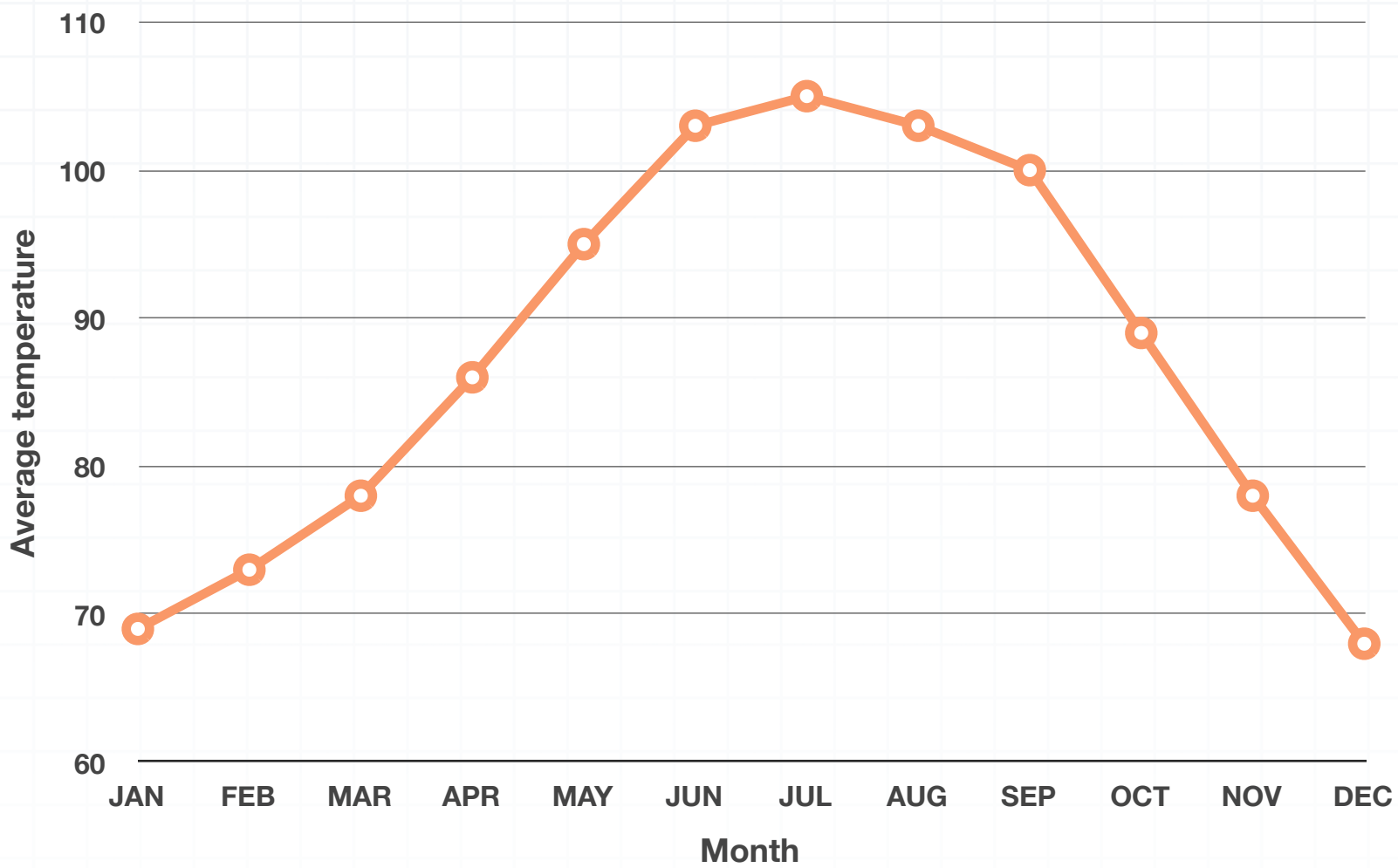


While this example is helpful for illustrating how we can transition from a bar graph to a line graph, and how the two graph types are related, in actuality, a line graph is a bad choice for this data. Line graphs are used to show changes over time or a connection between individuals, but this data is comparing things between different groups. That means the bar graph is a better choice than a line graph for this data in particular.

Let's look at an example with data that's much better suited for a line graph, like the monthly average high temperature in Scottsdale, Arizona over the course of a year. The data is

Month	Average high
JAN	69
FEB	73
MAR	78
APR	86
MAY	95
JUN	103
JUL	105
AUG	103
SEP	100
OCT	89
NOV	78
DEC	68

The historical average high temperature in degrees Fahrenheit is given for each month. If we plot these as a line graph, we get



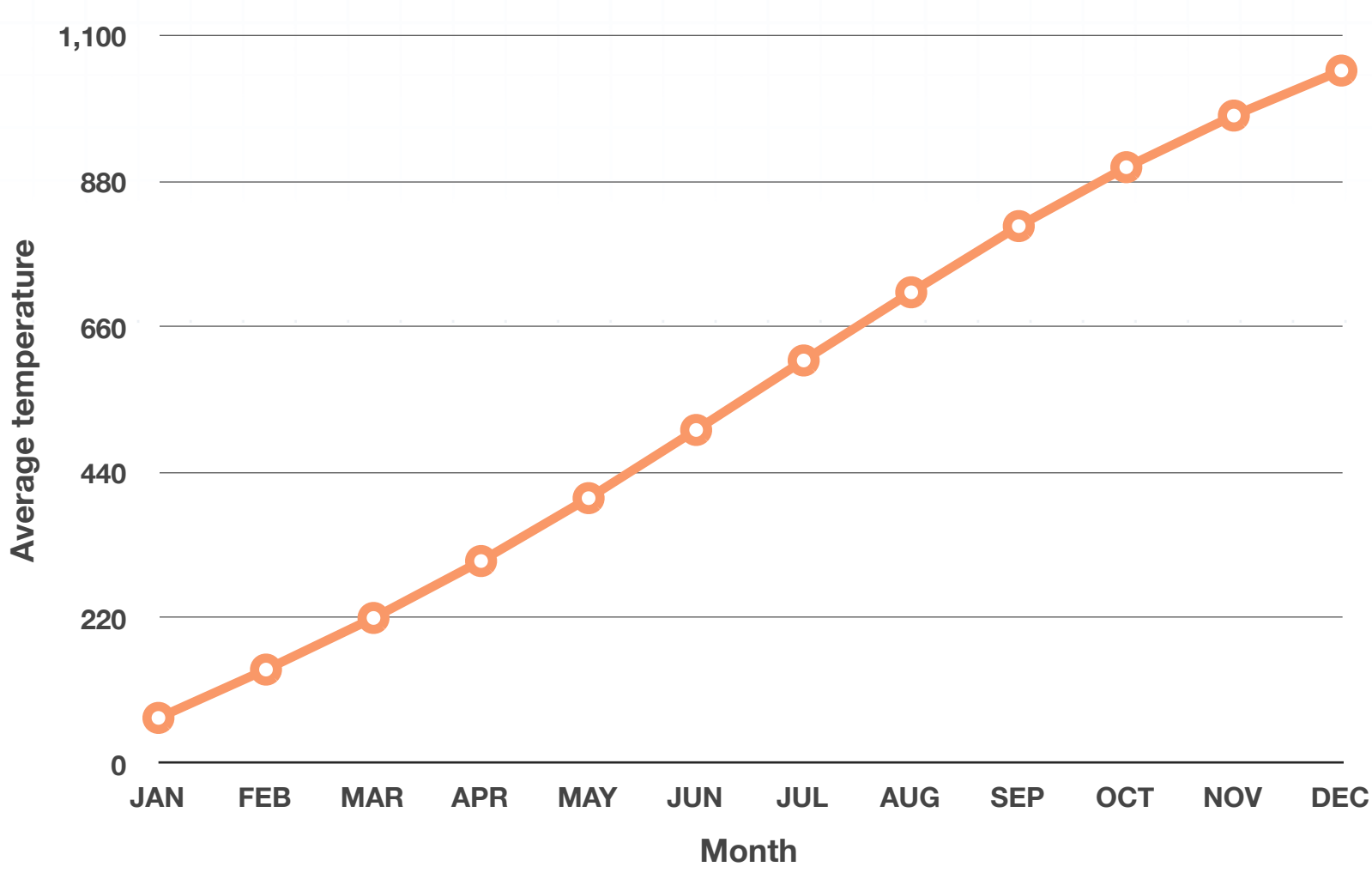
Notice that the slope of each line segment gives you and idea of how much change occurred between two data points. For example, there's a much larger change in average high temperature between October and November than there is between June and July. The slope of the line connecting October to November is much steeper, indicating a larger decrease in temperature, than the slope of the line connecting June to July, which is much flatter, and therefore indicates a smaller increase in temperature.

A line graph is a fantastic way to display this kind of data, mostly because it shows clearly how a data point changes over time. We inherently understand that average high temperature fluctuates over the course of a year, with the highest temperatures usually occurring in the summer months, and the lowest temperatures usually occurring the winter months.

Ogives

An **ogive** is a special kind of line graph. This kind of graph looks just like a line graph, but think of an ogive as an "accumulated" line graph. Just like other types of graphs, an ogive does well at representing some kinds of data, and less well at representing others.

For example, it doesn't make sense to show accumulated temperature over time. Taking the average monthly temperature in Scottsdale, if we use an ogive, we should show the temperature in January as 69, the temperature in February as $69 + 73$, the temperature in March as $69 + 73 + 78$ etc. The ogive would look like this:

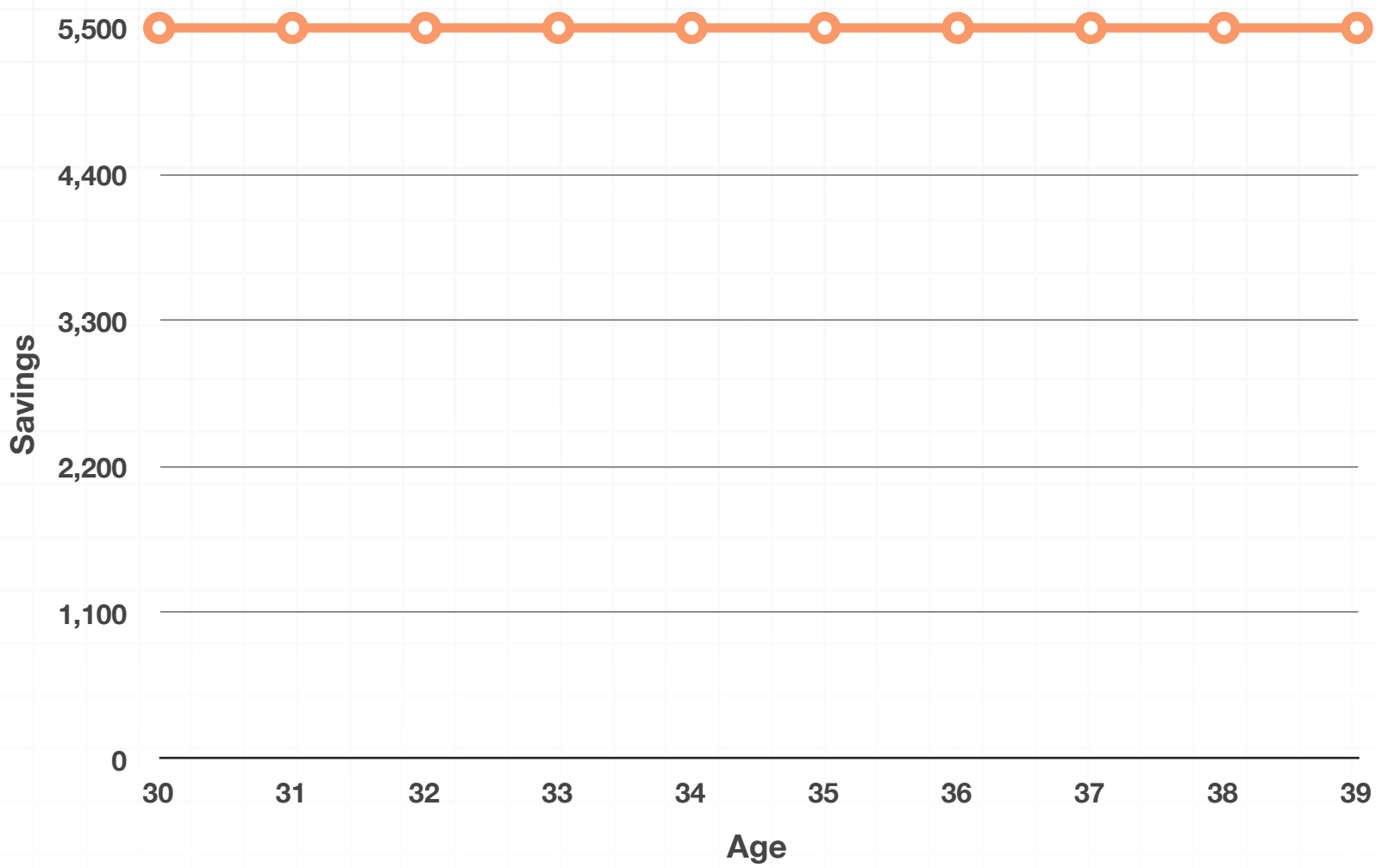


But it doesn't make sense to have a temperature of almost $1{,}100$ degrees in December. Temperature is not a very good data point to represent with an ogive.

But an ogive would be perfect for showing something like accumulated savings over time. For example, let's say you invest $\$5{,}500$ each year into a Roth IRA retirement savings account, from age 30 until age 39.

Age	Investment
30	$5,500
31	$5,500
32	$5,500
33	$5,500
34	$5,500
35	$5,500
36	$5,500
37	$5,500
38	$5,500
39	$5,500

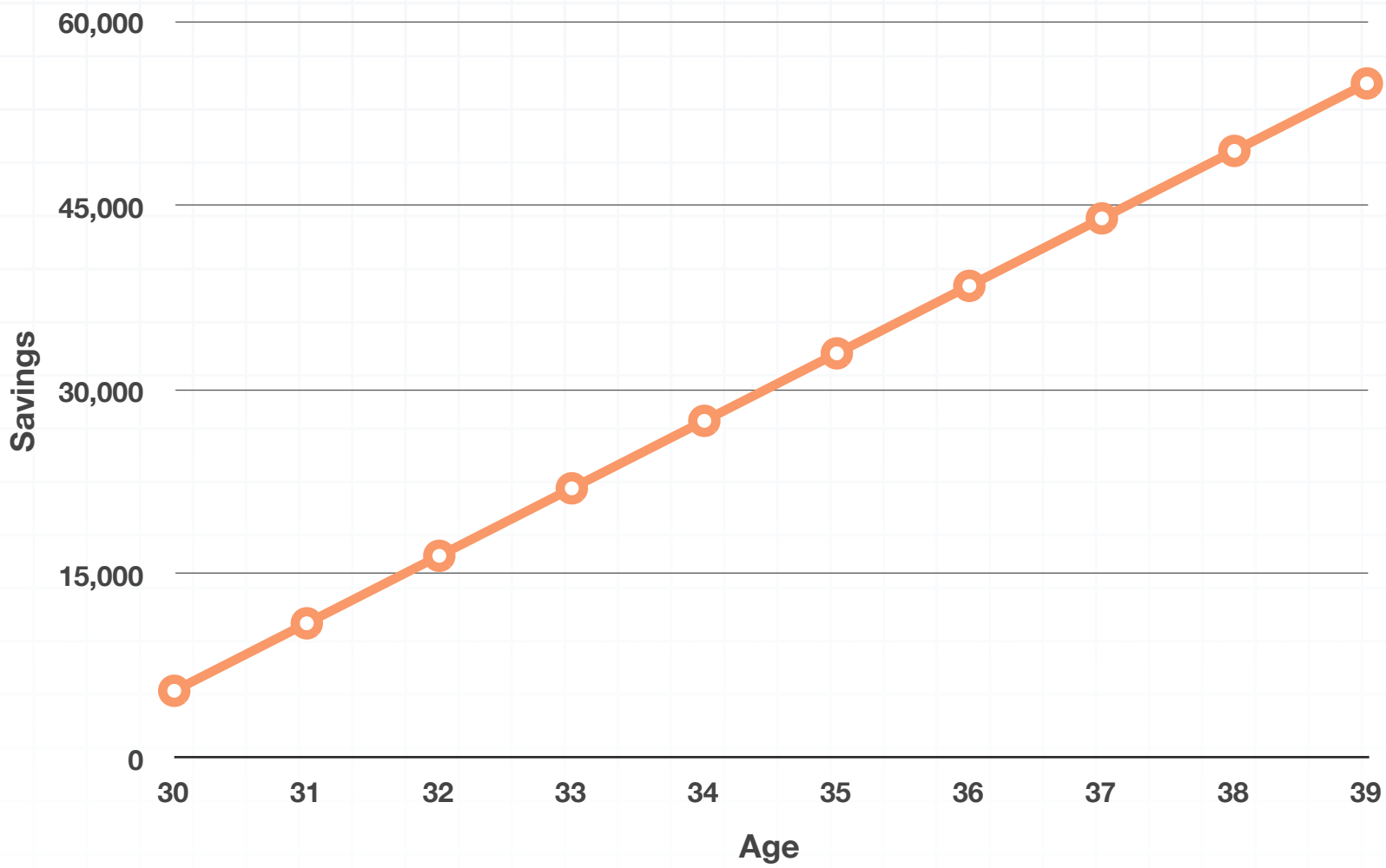
Graphing the invested amount each year in a line graph gives



While this is valuable information, you might be even more interested in the accumulated amount over time. If you find the accumulated total after each year, the data is

Age	Investment	Total
30	$5,500	$5,500
31	$5,500	$11,000
32	$5,500	$16,500
33	$5,500	$22,000
34	$5,500	$27,500
35	$5,500	$33,000
36	$5,500	$38,500
37	$5,500	$44,000
38	$5,500	$49,500
39	$5,500	$55,000

Graphing the accumulated total each year could be much more valuable, because it gives you visibility into how your savings will grow over time.



From this ogive, we can quickly see that we'll have something between $\$50{,}000$ and $\$60{,}000$ once we've made our investment at age 39. Or we can see that we'll cross the $\$30{,}000$ mark once we make our investment at age 35.

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