Relations and Models Task Cards

Print double-sided (flip on the long edge: Long-Edge binding): three sheets. Cards 3 and 5 are double width. Sheet 3 holds Card 7 only; its other three slots are empty. Cut along the frames.

Card 1

Education	Years (as reported)	Average salary (US$), 2002 data
Less than Grade 9	9.0	16 322
Some high school	10.5	19 095
High school diploma	12.0	25 081
Some university	13.0	29 903
3-year university degree	14.0	31 358
4-year university degree	17.0	41 361
Master's degree	19.0	50 704
Medical or law degree	22.0	76 659
Doctorate (PhD)	23.0	71 541

Average salary per year. Source: Augusta State University.

Two quantities change together in this table. Which one depends on the other? What would you call each kind of quantity?

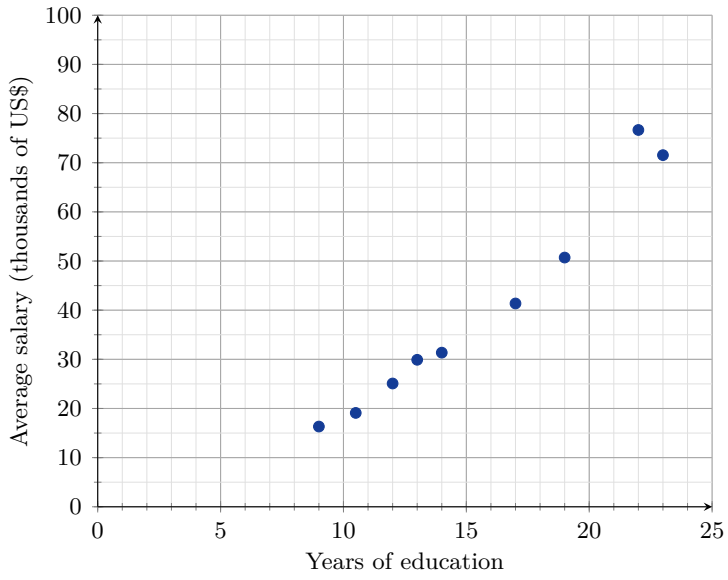
Card 2

Write the first four rows of the table on Card 1 as pairs of numbers in brackets, with the quantity that depends on the other second.

Why does the order inside each bracket matter?

What do we call a set of ordered pairs like this, linking two quantities?

Card 3



Here is the table of values from Card 1 as a graph: each pair is a point.

Which quantity did I put across the bottom?

Why did I put that quantity on the horizontal axis?

What does the graph tell you at a glance that the table did not?

Relations and Models Task Cards — Backs

Answers for the cards on the other side of this sheet.

Card 2 — answer

$(9,\ 16\,322)$, $(10.5,\ 19\,095)$,
$(12,\ 25\,081)$, $(13,\ 29\,903)$

Swap the numbers and the pair means something else.

A set of ordered pairs linking two quantities is a **relation**.

Card 1 — answer

Average salary depends on years of education.

Years of education: the **independent variable**.

Average salary: the **dependent variable**.

Card 3 — answer

Years of education goes across, because it is what we predict salary from; the dependent quantity, salary, goes up.

The picture shows the rise, how tight it is, and where it bends, in one look.

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Card 4

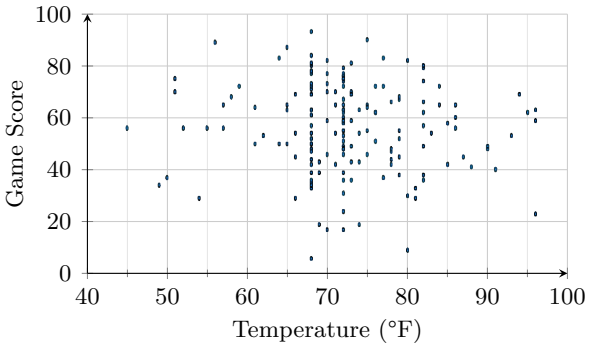
You now have this relation as a table of values (Card 1) and as a graph (Card 3). Look at the graph as a whole, not point by point, and say the relation in words:

- As years of education go up, what happens to salary?
- How closely do the points follow the pattern?
- What shape do the points make?

Write one or two sentences that someone who has not seen the graph could picture.

Card 6

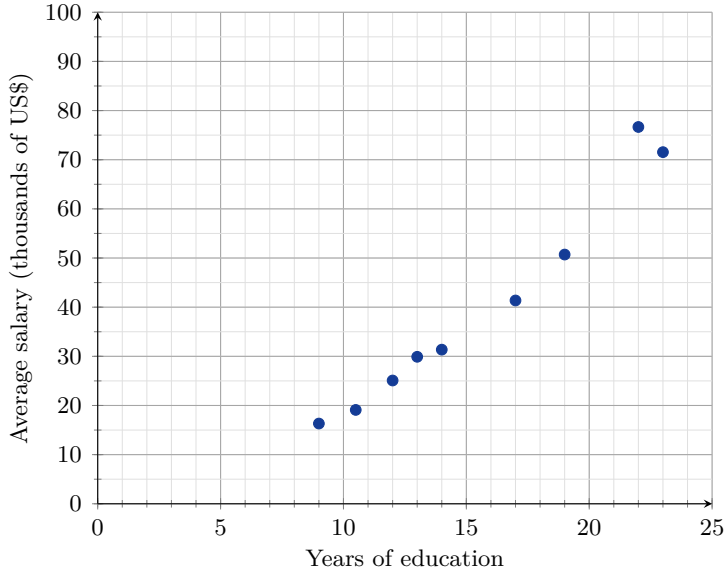
A sportswriter for the *Toronto Star* claimed in the early 2000s that Roy Halladay, a Blue Jays pitcher, pitched poorly in hot weather. Each point is one of his starts; a higher Game Score means a better start.



Data compiled by Rob Pettapiece.

Is there a trend? Where would a line of best fit go? Does the data support the claim?

Card 5



Here is the graph from Card 3 again.

Lay a straightedge (a ruler or the edge of a card) along the trend of the points, and hold it there.

Read off the average salary it gives for someone with 16 years of education, and for 25 years. Write your estimates on your board.

Which estimate do you trust more? Why?

Relations and Models Task Cards — Backs

Answers for the cards on the other side of this sheet.

Card 6 — answer

No clear trend: at every temperature, Game Scores run from low to high.

Any line would be nearly flat, around a Game Score of 55, with points far from it, so it predicts almost nothing.

The data does not support the claim: his hot-weather starts are about as good as the rest. A model is only as good as the relation behind it.

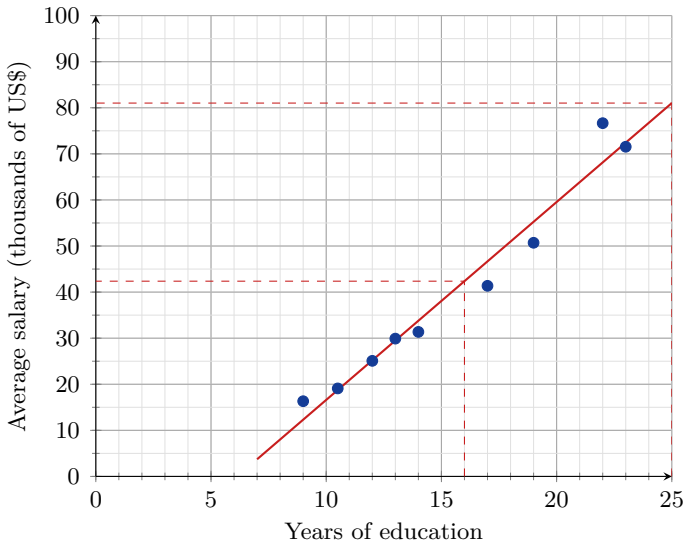
Card 4 — answer

As years of education increase, average salary increases: a **positive correlation** (up to the right).

The points lie close to the pattern: **strong**.

The points lie close to a line. Some groups may see a slight upward bend; accept it.

Card 5 — answer



One possible line, with the two readings dashed.

16 years: about \$36 000 to \$49 000.
25 years: about \$75 000 to \$90 000.

Trust 16 years more: it is inside the data (**interpolation**). 25 years is beyond the data (**extrapolation**); the pattern may not continue.

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Card 7

So far you have the salary relation in words, as a table of values, and as a graph.

Get one group member's thumb and palm graph from the warmup. Predict palm area for a 12 cm thumb. Can you do it?

For the salary line on Card 5, can you predict how many years of education would roughly be needed for an annual salary of \$100 000?

Why or why not? What would help you make those predictions?

Relations and Models Task Cards — Backs

Answers for the cards on the other side of this sheet.

Card 7 — answer

A relation can be described in words, as a table of values, as an equation, and as a graph. The salary relation has three of these: words, a table, and a graph. It has no equation yet.

A line of best fit is a model, and a model can have an equation that predicts with no grid at all.

How can we describe a curve with an equation well enough to predict from it? That is the question this thread answers.