Model Match

Sort models by how they handle variability

S.Q.1 "Understand the distinction between mathematical models and statistical models. Distinguish among different sources of variability, including measurement, natural, induced, and sampling variability..."

NAME _____ DATE _____

MATHEMATICAL MODEL

This model uses a specified relationship to give one output for each set of inputs, under its assumptions. It does not use variable data to estimate a pattern.

A recipe uses exactly 4 grams of yeast per batch, so y = 4b gives the grams of yeast needed for b batches.

STATISTICAL MODEL

This model uses data to estimate a pattern or predict an outcome while accounting for variability or uncertainty. Variability can come from measurement, natural differences, assigned conditions, or sampling.

A model uses salinity readings from several months to estimate how a river's salinity changes over time.

1 SORT

8 items

Circle MATH or STATS for each model, then choose one item from each category and explain how you knew.

1.	A model uses repeated thermometer readings of the same water bath to estimate its temperature and the spread of the readings.	MATH STATS
2.	A rectangular poster's area is modeled by A = lw, using given exact side lengths.	MATH STATS
3.	At an assumed constant speed of 72 km/h, distance in kilometers is modeled by d = 72t for t hours.	MATH STATS
4.	A model estimates the distribution of heights of mature oak trees in one forest.	MATH STATS
5.	A model estimates the effect of two assigned light schedules on tomato growth using data from several plants under each schedule.	MATH STATS
6.	A model estimates the share of city residents who ride the bus from 400 randomly sampled residents and gives a margin of error.	MATH STATS
7.	A $600 deposit earning a fixed 2% annual rate is modeled by $B = 600(1.02)^y$ after y years.	MATH STATS
8.	In an ideal circuit with a fixed resistance of 5 ohms, voltage is modeled by V = 5I for current I.	MATH STATS

2 PROVE IT

Explain your thinking

Choose one item from each category and explain how you knew.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new mathematical model and one new statistical model, and state what each model describes.

MATH _____

STATS _____

CHALLENGE

Choose one MATH item, name a possible source of variability, and rewrite it as a STATS model with a statistical question.

ANSWER KEY

Model Match

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	A model uses repeated thermometer readings of the same water bath to estimate its temperature and the spread of the readings.	**STATS**	Repeated readings have measurement variability, which the model estimates.
2	A rectangular poster's area is modeled by A = lw, using given exact side lengths.	**MATH**	The given lengths determine one area through a fixed relationship.
3	At an assumed constant speed of 72 km/h, distance in kilometers is modeled by d = 72t for t hours.	**MATH**	The assumed speed and time determine one distance.
4	A model estimates the distribution of heights of mature oak trees in one forest.	**STATS**	The model describes natural variability among trees.
5	A model estimates the effect of two assigned light schedules on tomato growth using data from several plants under each schedule.	**STATS**	The assigned schedules induce differences, and growth also varies among plants.
6	A model estimates the share of city residents who ride the bus from 400 randomly sampled residents and gives a margin of error.	**STATS**	The estimate accounts for sampling variability.
7	A $600 deposit earning a fixed 2% annual rate is modeled by $B = 600(1.02)^y$ after y years.	**MATH**	The fixed rate, starting amount, and time determine one balance.
8	In an ideal circuit with a fixed resistance of 5 ohms, voltage is modeled by V = 5I for current I.	**MATH**	The assumed resistance and given current determine one voltage.

PART 2 · PROVE IT

Task: Choose one item from each category and explain how you knew.
Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **MATH**: For a fixed admission price of $12 per visitor, R = 12n models the revenue from n visitors.
- **STATS**: A model estimates average sleep time on school nights from a random sample of 120 students and reports a margin of error.

Challenge: Item 2, measurement variability: Measure the poster's length and width several times, then model the distribution of calculated areas to estimate its area and uncertainty. How much do the area estimates vary across repeated measurements?

For Part 2, item 2 fits MATH because exact lengths give one area through A = lw. Item 4 fits STATS because tree heights differ naturally, so its model describes a distribution.