Before the Brakes

Read a bicycle stopping-distance model through its terms and data.

9-10.RST.4 "Determine the meaning of symbols, equations, graphical and tabular representations, domain-specific and content-specific words and phrases including relationships among key terms (e.g., force, friction, reaction force…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the three distance terms, underline the clues that explain each one, and number the matching table headings to show which distance comes first, which comes second, and which is the total.

A Dog in the Bike Lane

1. A cyclist spots a dog stepping toward the bike lane. Even after noticing the dog, the bicycle keeps moving while the rider decides to squeeze the brakes. Engineers call the ground covered during that delay **reaction distance**. Once the brake pads press against the wheel rim, friction slows the bike. That second stretch is **braking distance**.

2. The table models a rider on level, dry pavement with a reaction time of about 1.1 seconds. Distances are rounded to the nearest meter. **Stopping distance** means the entire stretch from seeing the dog to coming to a stop. In this model, reaction distance plus braking distance equals stopping distance.

MODELED BICYCLE STOPPING DISTANCES

Speed (km/h)	Reaction distance (m)	Braking distance (m)	Stopping distance (m)
10	3	2	5
20	6	8	14
30	9	18	27

3. The table holds reaction time and braking strength constant, so speed is the factor that changes. At twice the speed, the rider travels twice as far before braking begins. Braking distance grows faster because the moving bicycle has more kinetic energy for friction to remove. The data describe this model, not a promise about every road.

2 ANSWER WITH EVIDENCE

Use the passage

1. In the passage, what event begins reaction distance, and what event ends it?

2. At 20 km/h, what does the table's stopping distance of 14 meters measure? Show how the other two distances make that total.

3. Compare the 10 and 20 km/h rows. What happens to reaction distance and braking distance when speed doubles?

4. In the final paragraph, what does “more kinetic energy for friction to remove” tell you about braking distance as speed rises?

3 YOUR TURN

Your own words

Imagine the same rider sees a fallen branch while traveling at 40 km/h under the table's conditions. In three sentences, predict the reaction, braking, and stopping distances, and explain the table patterns behind your estimates.

Before the Brakes

PART 1 · READ AND MARK

Circle the three distance terms, underline the clues that explain each one, and number the matching table headings to show which distance comes first, which comes second, and which is the total. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In the passage, what event begins reaction distance, and what event ends it?	**It begins when the cyclist sees the dog and ends when the rider starts to squeeze the brakes.**
2	At 20 km/h, what does the table's stopping distance of 14 meters measure? Show how the other two distances make that total.	**It measures travel from seeing the dog until the bike stops: 6 meters of reaction distance plus 8 meters of braking distance.**
3	Compare the 10 and 20 km/h rows. What happens to reaction distance and braking distance when speed doubles?	**Reaction distance doubles from 3 to 6 meters, while braking distance quadruples from 2 to 8 meters.**
4	In the final paragraph, what does “more kinetic energy for friction to remove” tell you about braking distance as speed rises?	**A faster bicycle takes a longer distance to stop after braking begins because friction must remove more kinetic energy.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

At 40 km/h, the reaction distance is about 12 meters, twice its value at 20 km/h. The braking distance is about 32 meters, four times its value at 20 km/h because doubling speed quadruples braking distance in this model. The stopping distance is about 44 meters, the sum of those two distances.

For Your Turn, accept about 12 meters, 32 meters, and 44 meters when the student explains the doubling and quadrupling patterns. Treat the estimates as predictions under the stated model, not guaranteed distances on a real road.