

Thinking with Models _ Gradient of a line

Investigation Task: Designing a Wheelchair Ramp

Assessment Criterion: D and C

Criterion D: Apply Mathematics in real life context

Achievement Level	Descriptor (Task-Specific, Gradient Ramp Context)	Sample Response (Student Evidence)
0	The student is able to demonstrate no understanding of the problem or attempt a solution.	No calculations or reasoning provided; the student does not address ramp gradient or safety.
1–2	The student is able to identify some relevant elements of the authentic real-life situation but selects inappropriate mathematical strategies.	Student mentions the ramp height but calculates the length incorrectly or ignores safety rules.
3–4	The student is able to identify most relevant elements of the real-life situation and selects some appropriate mathematical strategies.	Student identifies ramp height (1.2 m) and available space (10 m), calculates gradient approximately, but rounding errors or incomplete justification.
5–6	The student is able to: <ul style="list-style-type: none"> • identify the relevant elements of the authentic real-life situation, • select appropriate mathematical strategies to model the authentic real-life situation, • apply the selected mathematical strategies to reach a correct solution to the authentic real-life situation, • justify the degree of accuracy of the solution, • justify whether the solution makes sense in the context of the authentic real-life situation 	Sample Response: <ul style="list-style-type: none"> - Identifies ramp rise = 1.2 m, available length = 10 m, maximum safe gradient 1:12. - Uses formula gradient = rise/run to model ramp. - Calculates actual gradient = $1.2/10 = 0.12 \rightarrow$ ratio 1:8.33. - Explains rounding and measurement assumptions for accuracy. - Concludes that $1:8.33 > 1:12$, so the ramp is too steep and unsafe; recommends increasing length or redesigning.
7–8	The student is able to: <ul style="list-style-type: none"> • identify all relevant elements of the authentic real-life situation with clarity, • select and justify highly appropriate mathematical strategies to model the situation, • apply the selected mathematical strategies accurately to reach a fully correct solution, • critically justify the degree of accuracy of the solution, 	Sample Response: <ul style="list-style-type: none"> - Clearly identifies rise = 1.2 m, maximum allowed gradient 1:12, available space = 10 m, safety requirements. - Uses gradient formula, converts to ratio, checks against guideline.

	<ul style="list-style-type: none"> critically justify whether the solution makes sense in the context of the authentic real-life situation, including potential real-world implications 	<ul style="list-style-type: none"> Calculates gradient = 0.12 (1:8.33), explains rounding to 2 decimal places, notes assumptions in available construction space. Critically evaluates: ramp is unsafe, risk for wheelchair users; discusses options like extending ramp length or redesigning slope. Uses mathematical reasoning to justify both numerical solution and real-world decision-making.
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Criterion C: Communicating

Achievement Level	Descriptor (Task-Specific, Gradient Ramp Context)	Sample Response (Student Evidence)
0	The student is able to demonstrate no attempt to communicate mathematical reasoning.	No calculations, diagrams, or explanations provided.
1–2	The student is able to use some mathematical language and representation, but inconsistently or incorrectly, with limited organization.	Student writes “ramp is steep” without using gradient, ratio, or units; shows a rough diagram but no labels.
3–4	The student is able to use appropriate mathematical language and representation in some parts, communicates reasoning partially, and organizes work in a basic way.	Student calculates gradient = 0.12, mentions “1:8.3 ratio,” draws diagram of ramp with some labels, but reasoning is incomplete or steps are unclear.
5–6	The student is able to: <ul style="list-style-type: none"> consistently use appropriate mathematical language, use appropriate forms of mathematical representation to present information correctly, move effectively between different forms of mathematical representation, communicate through lines of reasoning that are complete, coherent and concise, present work that is consistently organized using a logical structure 	Sample Response: <ul style="list-style-type: none"> Uses terms: gradient, rise, run, ratio, units. - Presents gradient as decimal (0.12) and ratio (1:8.33), includes labeled diagram of ramp. Shows calculation steps clearly: rise/run → ratio → comparison with safe gradient. Explains reasoning concisely: “Gradient 1:8.33 > 1:12 → ramp too steep.” Work structured logically: problem statement → calculation → interpretation → recommendation.
7–8	The student is able to:	Sample Response:

	<ul style="list-style-type: none">• consistently and accurately use precise mathematical language,• confidently use multiple forms of representation to present information correctly,• move seamlessly between different forms of representation,• communicate reasoning that is fully complete, coherent and concise,• present work that is exceptionally well organized using a clear logical structure	<ul style="list-style-type: none">- Uses precise language: “rise,” “run,” “gradient,” “ratio,” “slope,” “maximum allowable gradient.”- Represents gradient numerically, as ratio, and visually in diagram with labels.- Explains reasoning in full sentences connecting calculations to safety standards.- Seamlessly moves from formula → decimal → ratio → graphical representation.- Logical flow: introduction/context → calculations → justification → recommendation; work is neat, clearly labeled, easy to follow.
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