

Unit 5 Assessment

Part 2B: Application AI Assignment

DUE DATE: Submit by 4pm on Thursday May 7th 2026 in GClassroom

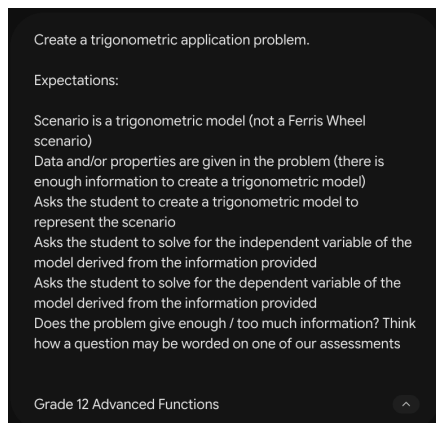
Your Task:

- Open gemini.google.com
- Ask Gemini to create a trigonometric application problem.
- Analyse the problem Gemini gave and check if it meets the expectations:
 - ◆ Scenario is a trigonometric model (not a Ferris Wheel scenario)
 - ◆ Data and/or properties are given in the problem (there is enough information to create a trigonometric model)
 - ◆ Asks the student to create a trigonometric model to represent the scenario
 - ◆ Asks the student to solve for the independent variable of the model derived from the information provided
 - ◆ Asks the student to solve for the dependent variable of the model derived from the information provided
 - ◆ Does the problem give enough / too much information? Think how a question may be worded on one of our assessments
- If the above expectations are not met, prompt Gemini to edit the problem.
- Screenshot **your prompt** and the **corresponding response(s)** from Gemini.

- YOU provide a **complete solution** to the problem.
 - ◆ Make sure there is no reason for tech marks to be deducted

- Ask Gemini to solve the problem. Screenshot **your prompt** and the **corresponding response** from Gemini.
- Complete the following table below to compare your solution with Gemini's solution. There should be **at least 3** (in total) clear and concise similarities and differences noted. These can range from generic to specific comparisons.
- Use the template on the next page to complete the assessment. Add space as needed.

Gemini Prompt:



The Application Question Gemini Created
(Screenshot must include the complete set of prompts and responses to get the question with all the expectations)

Here is a rigorous, assessment-style trigonometric application problem tailored for Grade 12 Advanced Functions. It uses a tidal scenario (a classic alternative to the Ferris wheel) and is designed to mimic the complexity and phrasing of a typical evaluation.

The Problem: The Bay of Fundy Tides

A team of marine biologists is studying the movement of a research vessel anchored in a harbor off the Bay of Fundy. Due to the extreme tides, the depth of the water beneath the boat changes sinusoidally throughout the day.

On a specific day, the first **low tide** occurs at 4:00 AM, with a minimum water depth of 2.4 m. The subsequent **high tide** occurs at 10:15 AM, reaching a maximum water depth of 11.6 m.

Your Task:

1. **Create the Model:** Determine a sinusoidal function, $d(t)$, that models the depth of the water in meters, where t represents the number of hours after midnight ($t = 0$).
2. **Solve for the Dependent Variable:** A large supply ship requires a minimum water depth of 9.5 m to safely dock. Determine the depth of the water at 1:30 PM. Will the supply ship be able to dock at this time?
3. **Solve for the Independent Variable:** The research vessel can only deploy its heavy diving equipment when the water depth is at least 8.0 m. Determine the first time frame *after noon* that the team can safely deploy the equipment.

Assessment Analysis (Teacher's Notes)

Does the problem give enough / too much information?

This problem gives **exactly the right amount of information**, structured precisely how a student would encounter it on a Grade 12 assessment.

- o **No Information Overload:** It avoids giving unnecessary data like the phase shift directly, forcing the student to calculate it using the time of the low or high tide.
- o **Hidden Complexity (Time Conversion):** A common pitfall for students is treating "10:15 AM" as 10.15 hours. They must convert minutes to decimal hours (e.g., 10:15 AM = 10.25 hours, 4:00 AM = 4 hours). This tests their attention to detail and true understanding of the independent variable.
- o **Period Calculation:** Instead of giving the full period, it gives the time from a minimum to a maximum. Students must recognize this represents *half* of the tidal cycle, meaning the full period is $2 \times (10.25 - 4) = 12.5$ hours.
- o **Domain Awareness:** Part 3 asks for a time *after noon* ($t > 12$). This prevents students from just finding the very first mathematical solution near $t = 0$ and forces them to use the period to find subsequent intervals.

Your Complete Solution

Unit 5 Assessment Application A1 Assignment

The first low tide occurs at 4:00 AM, with a minimum water depth of 2.4m. The subsequent high tide occurs at 10:15 AM, reaching a maximum water depth of 11.6m.

1. Determine a sine function, $d(t)$, that models the depth of the water in meters, where t represents the number of hours after midnight ($t=0$).
2. A large supply ship requires a minimum water depth of 4.5m to safely dock. Determine the depth of the water at 1:30 PM. Will the supply ship be able to dock at this time?
3. The research vessel can only deploy its heavy diving equipment when the water depth is at least 8.0m. Determine the first time after noon that the team can safely deploy the equipment.

Answers

1. Max depth: 11.6, Min: 2.4

$$\text{Amplitude: } \frac{11.6 - 2.4}{2} = 4.6, \text{ Vertical Shift: } \frac{11.6 + 2.4}{2} = 4$$

Period: 4:00 AM to 10:15 AM = half a cycle

4:00 AM to 10:15 AM is 6.25 hours, $6.25 \cdot 2 = 12.5$ (full period)

$$A = \frac{2\pi}{12.5} = \frac{2\pi}{\frac{25}{2}} = \frac{4\pi}{25}$$

Phase Shift: Starts at min (1:00 AM), $t = 4$

$d = 4$ units right

$$\text{Final Equation: } d(t) = -4.6 \cos\left(\frac{4\pi}{12.5}(t-4)\right) + 7$$

2. 1:30 PM is 13.5 hours after midnight. $t = 13.5$

Sub in $t = 13.5$

$$\begin{aligned} d(13.5) &= -4.6 \cos\left(\frac{4\pi}{12.5}(13.5-4)\right) + 7 \\ &= -4.6 \cos\left(\frac{4\pi}{12.5}(9.5)\right) + 7 \\ &= -4.6 \cos\left(\frac{38\pi}{25}\right) + 7 \\ &\approx -4.6(-0.3512) + 7 \\ &\approx 8.62 \text{ m} \end{aligned}$$

\therefore The water depth is about 8.62 m at 1:30 PM. Since 8.62 m is less than 9.5 m, the ship cannot safely dock.

3. Set $d(t) = 8$

$$8 = -4.6 \cos\left(\frac{4\pi}{12.5}(t-4)\right) + 7$$

$$1 = -4.6 \cos\left(\frac{4\pi}{12.5}(t-4)\right)$$

$$\cos\left(\frac{4\pi}{12.5}(t-4)\right) = -\frac{1}{4.6}$$

$$\frac{4\pi}{12.5}(t-4) = \cos^{-1}\left(-\frac{1}{4.6}\right)$$

$$\approx 1.4899$$

$$\frac{4\pi}{12.5}(t-4) = 2\pi - 1.4899$$

$$\approx 4.4933$$

$$t-4 = 4.4933 \cdot \frac{12.5}{4\pi}$$

$$\approx 2.9391$$

$$t = 12.9391$$

12.9391 is 12 hours and about 56 minutes

\therefore The team can deploy the safety equipment at 12:56 PM or later.

Gemini Solution

Part 1: Creating the Model

- Midline (C) = $\frac{11.6+2.4}{2} = 7.0$
- Amplitude (A) = $\frac{11.6-2.4}{2} = 4.6$
- Period (T) = $2 \times (10.25 - 4.0) = 12.5$ hours
- Using a decimal approximation for the horizontal compression factor:

$$k = \frac{2 \times 3.14159}{12.5} \approx 0.5027$$

- Phase shift for a minimum starting value is at $t = 4.0$.

$$d(t) = -4.6 \cos(0.5027(t - 4)) + 7$$

Part 2: Solving for the Dependent Variable

Evaluate the function at $t = 13.5$:

$$d(13.5) = -4.6 \cos(0.5027(13.5 - 4)) + 7$$

$$d(13.5) = -4.6 \cos(0.5027 \times 9.5) + 7$$

$$d(13.5) = -4.6 \cos(4.7757) + 7 \approx -4.6(-0.3512) + 7 \approx 8.62 \text{ m}$$

Statement: At 1:30 PM, the water conditions are insufficient for the supply ship to safely dock.

Part 3: Solving for the Independent Variable

Set $d(t) = 8.0$:

$$8.0 = -4.6 \cos(0.5027(t - 4)) + 7$$

$$\cos(0.5027(t - 4)) = \frac{1.0}{-4.6} \approx -0.2174$$

$$0.5027(t - 4) = \cos^{-1}(-0.2174) \approx 1.7901$$

Find the corresponding secondary angle in the next quadrant:

$$0.5027(t - 4) = (2 \times 3.14159) - 1.7901 = 4.4931$$

$$t - 4 = \frac{4.4931}{0.5027} \approx 8.9380 \implies t \approx 12.9380 \text{ hours}$$

Statement: Converting 12.9380 hours gives 12 PM + $(0.9380 \times 60) \approx 12:56$ PM. The team can safely begin deploying equipment at **12:56 PM**.

Similarities	Differences
1. Both solutions have the same exact amplitude of 4.6, a midline/vertical shift of 7, and a phase shift of 4 units	1. My solution uses exact numbers by using pi while the AI solution uses decimals which can make some of the

<p>right.</p> <ol style="list-style-type: none">Both solutions converted the times into decimals, for example, converting 1:30 PM to 13.5 hours.Both answers say that 6.25 hours (4:00 AM to 10:15 AM) is half of a cycle.	<p>numbers not as accurate.</p> <ol style="list-style-type: none">The final equation is different and mine is more exact since I use pi but the AI solution used decimals.In question 2, my therefore statement specifically states numbers like 8.62m is less than 9.5 m... but the AI's statement is the conditions are insufficient for the supply ship to safely dock, without stating specific numbers and this could result in a tech mark.
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Part 2B: Application AI Assignment RUBRIC

	Level 4 (Excellent)	Level 3 (Good)	Level 2 (Fair)	Level 1 (Needs Improvement)
<p>Communication</p> <p>Mathematical Form (Observational) /1</p> <p>Problem Analysis and Prompting /1</p>	<p>The student consistently uses proper mathematical form in their written work with precision and clarity.</p> <p>The student thoroughly analyzes Gemini's generated problem and demonstrates sophisticated prompting to ensure all required elements for a trigonometric model are present and clear.</p>	<p>The student generally uses proper mathematical form in their written work.</p> <p>The student analyzes Gemini's generated problem and uses effective prompting to ensure most required elements for a trigonometric model are present.</p>	<p>The student sometimes uses proper mathematical form in their written work, but inconsistencies or errors are present.</p> <p>The student attempts to analyze Gemini's problem and prompt for necessary elements, but the resulting problem may lack some clarity or sufficient information.</p>	<p>The student rarely uses proper mathematical form in their written work; significant errors are frequent.</p> <p>The student struggles to analyze Gemini's problem or to prompt effectively, resulting in a problem that does not meet the specified expectations.</p>
<p>Application</p> <p>Your Complete Solution /2</p>	<p>The student's complete solution (including the trigonometric model and accurate solving for both independent and dependent variables) is flawlessly executed, demonstrating a comprehensive understanding of sinusoidal functions and their application.</p>	<p>The student's complete solution (including the trigonometric model and accurate solving for both independent and dependent variables) is correct and effectively executed.</p>	<p>The student's complete solution attempts to create a model and solve for variables, but may contain minor errors or omissions.</p>	<p>The student's solution is largely incorrect, incomplete, or demonstrates a significant lack of understanding in creating the model or solving for variables.</p>
<p>Thinking</p> <p>Comparison /3</p>	<p>The student provides a thorough and insightful comparison of Gemini's solution to their own, identifying multiple (more than 3) clear, concise, and nuanced similarities and differences, demonstrating critical thinking and a deep understanding of the problem-solving process.</p>	<p>The student compares the Gemini's solution to their solution and provides at least 3 clear and concise similarities and differences.</p>	<p>The student attempts to compare the Gemini's solution to their own, but the comparison may be superficial, incomplete, or lack clarity and conciseness; fewer than 3 similarities and differences may be provided.</p>	<p>The student does not compare the Gemini's solution to their own, or the comparison is missing, irrelevant, or incomprehensible.</p>

TOTAL: 17