Task: Model the Rotation of the Earth on its Polar Axis

Student Text Pages
272–273

Suggested Timing
80–160 min

Materials and Technology Tools
- grid paper

Related Resources
- BLM G–1 Grid Paper
- BLM 5–17 Chapter 5 Task Rubric

Accommodations

Gifted and Enrichment–challenge students to research the rotation of the Earth and other planets and share the information with their classmates

Motor–have students work in groups to construct the 3-D model

Ongoing Assessment

- Use **BLM 5–17 Chapter 5 Task Rubric** to assess student achievement.

Specific Expectations

2.1, 2.2, 3.1, 3.2, 3.3

Teaching Suggestions

- You may wish to have students work in pairs or small groups to complete the task.
- Have students read the entire Task. Discuss the Task and ensure students understand what they are being asked to do.
- Distribute copies of **BLM G–1 Grid Paper**.

Hints for Evaluating a Response

Student responses are being assessed for the level of mathematical understanding they represent. As you assess each response, consider the following questions:

- How much assistance did the student need to create the table and draw the graphs?
- How much assistance did the student need to determine the maximum and minimum values, the intervals, and the equation?
- Which parts of the Task did the student complete/not complete?
- Did the student present work that was clear and easy to follow?
- Did the student demonstrate an understanding of the sine function?

Level 3 Notes

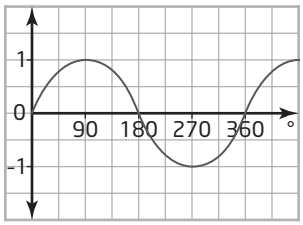
- Student demonstrates understanding of the sine function and the meaning of the equation and the shape of the graph in terms of the rotation of the Earth.
- Student demonstrates understanding of problem solving techniques.
- Student uses mathematical language effectively.
- Student's solution is clearly organized and choices are justified
- Student's 3-D model represents the position of the sun as the Earth rotates on its axis.
- Student's solution may contain minor errors.

Level 3 Sample Response

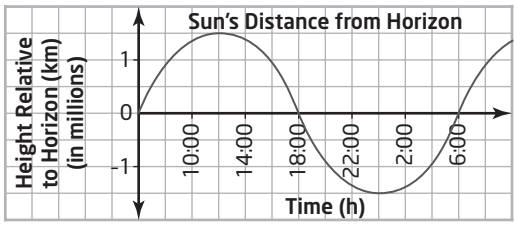
a)

Time of Day	θ	$\sin\theta$	Position Relative to Horizon
06:00	0°	0.0	0
08:00	30°	0.5	75 000 000
10:00	60°	0.866	129 903 811
12:00	90°	1	150 000 000
14:00	120°	0.866	129 903 811
16:00	150°	0.5	75 000 000
18:00	180°	0.0	0
20:00	210°	−0.5	−75 000 000
22:00	240°	−0.866	−129 903 811
00:00	270°	−1	−150 000 000
02:00	300°	−0.866	−129 903 811
04:00	330°	−0.5	−75 000 000
06:00	360°	0.0	0

b)



c)



d) The time when the sun is directly above the opposite side of the Earth; the time is when the sun is directly overheard.

e) Increasing: 00:00 to 12:00; decreasing: 12:00 to 00:00

f) $150\,000\,000 \sin(15x - 90)$

What Distinguishes Level 2

- Student demonstrates some understanding of the sine function and the meaning of the equation and the shape of the graph in terms of the rotation of the Earth.
- Student demonstrates some understanding of problem solving techniques.
- Student uses mathematical language somewhat effectively.
- Student's solution is somewhat organized and choices are partially or ineffectively justified.
- Student's 3-D model inaccurately represents the position of the sun as the Earth rotates on its axis.
- Student's solution may contain some significant errors.

What Distinguishes Level 4

- Student demonstrates thorough understanding of the sine function and the meaning of the equation and the shape of the graph in terms of the rotation of the Earth.
- Student demonstrates thorough understanding of problem solving techniques.
- Student uses mathematical language effectively.
- Student's solution is highly organized and choices are clearly justified.
- Student's 3-D model accurately and effectively represents the position of the sun as the Earth rotates on its axis.
- Student's solution contains very few or no errors.