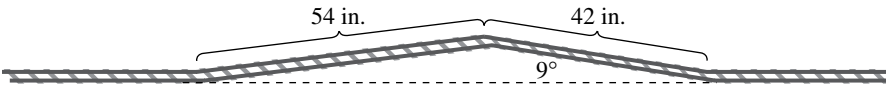


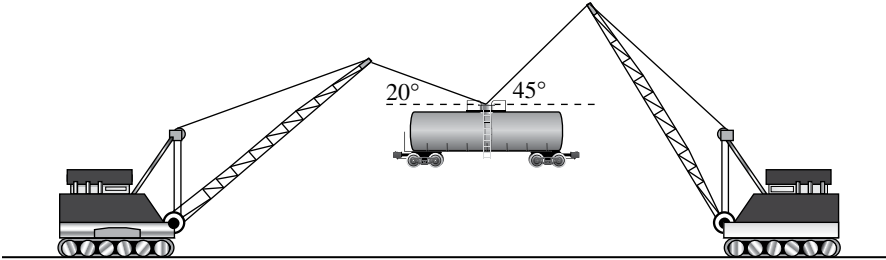
## Collaborative Project — Additional Topics in Trigonometry

A model train diorama is built on a large platform.

- At one point, the miniature train track has a 54-inch incline, then 42-inch decline back to the original horizontal plane. The decline makes an angle of  $9^\circ$  with the horizontal plane. Find the angle between the incline and the horizontal plane to the nearest tenth of a degree.



- Two cranes lift a tanker car weighing 4 ounces. One crane lifts at an angle of  $20^\circ$  to the horizontal and the other crane lifts at  $45^\circ$  to the horizontal. Find the tension (in ounces) in the cable of each crane.



- Two straight sections of track meet at a railroad intersection with a  $100^\circ$  angle. One track runs west to east and the other runs northeast to southwest. The first track comes to a covered bridge 18 inches east of the intersection. The other track comes to a railroad station 24 inches southwest of the intersection. How far is the railroad station from the covered bridge?
- Three roads in the diorama border a triangular park with side lengths of 10 inches, 14 inches, and 16 inches. What is the area of the park?
- A locomotive engine weighing 2 pounds is stopped on an incline that forms an angle of  $13^\circ$  with the horizontal (see the figure). What force is required to keep the locomotive from rolling down the incline?
- The figure shows the engine spraying a puff of smoke from its smokestack like an actual steam engine. The direction of the spray is perpendicular to the engine, with a velocity of 10 inches per second. Find the horizontal and vertical components of the velocity.

