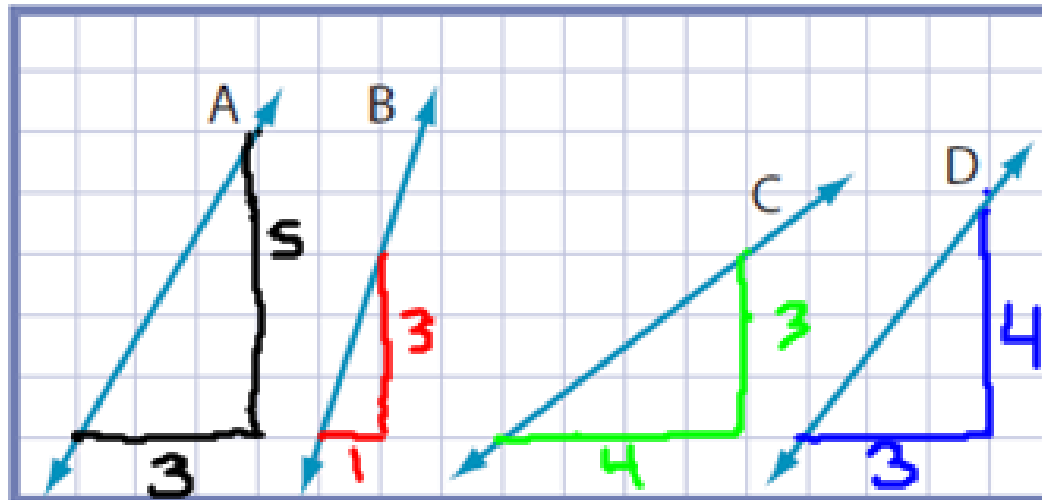


1. Examine lines A, B, C, and D on the grid. Just by looking, can you tell which line is the steepest? Which line is the least steep?



Steepest : B
Least steep : C

$$m_A = \frac{5}{3} = 1.67$$

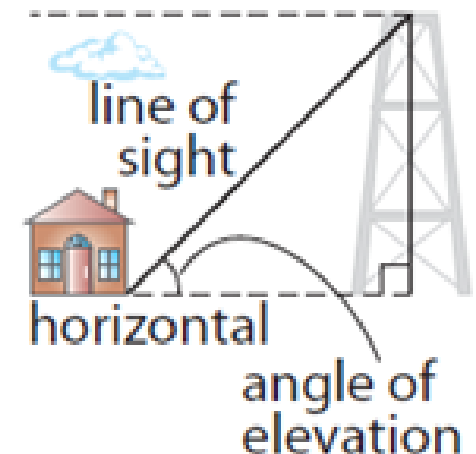
$$m_B = \frac{3}{1} = 3$$

$$m_C = \frac{3}{4} = 0.75$$

$$m_D = \frac{4}{3} = 1.33$$

angle of elevation

- an angle formed by the horizontal and a line of sight above the horizontal line



Finding the angle of elevation

opposite, hypotenuse, adjacent

Before we learn how to find the angle of elevation, we have to quickly go back to right angle trig for a few moments...

SOH

CAH

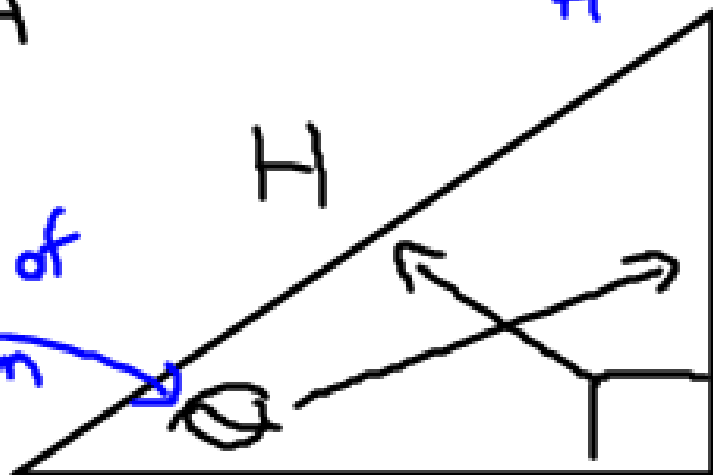
TOA

$$\sin \theta = \frac{O}{H}$$

$$\cos \theta = \frac{A}{H}$$

$$\tan \theta = \frac{O}{A}$$

angle of elevation



$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

run

$$\tan \theta = \frac{\text{rise}}{\text{run}}$$

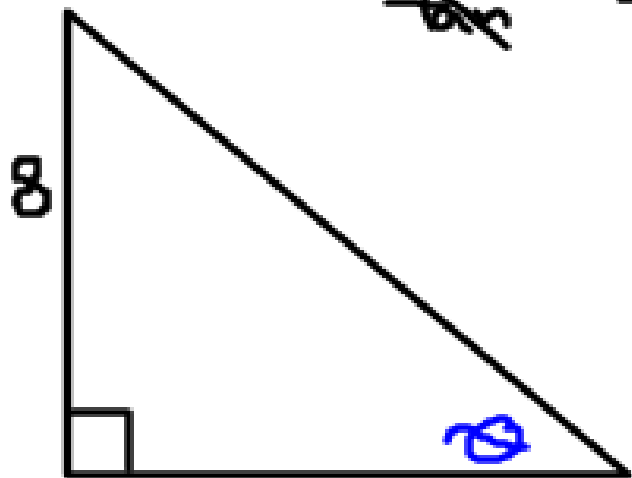
○ $\tan \theta = \text{slope}$

rise

$$\cancel{\tan^{-1}} \tan \theta = \tan^{-1} \left(\frac{\text{rise}}{\text{run}} \right)$$

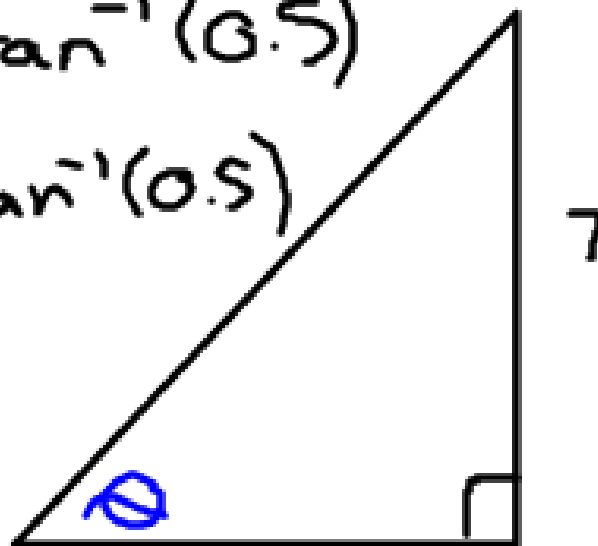
$$\theta = \tan^{-1} \left(\frac{\text{rise}}{\text{run}} \right)$$

Example - Find the tangent ratio for each of the following triangles. Then solve for the angle of elevation.



$$\tan \theta = 0.5$$
~~$$\tan^{-1} \tan \theta = \tan^{-1}(0.5)$$~~

$$\theta = \tan^{-1}(0.5)$$



$$\tan \theta = \frac{8}{6}$$

$$\tan \theta = \frac{\text{rise}}{\text{run}}$$

$$\tan \theta = \frac{8}{6}$$

$$\tan \theta = 1.3333$$

$$\theta = \tan^{-1}(1.3333)$$

$$\theta = 53.13^\circ$$

$$\tan \theta = \frac{\text{rise}}{\text{run}}$$

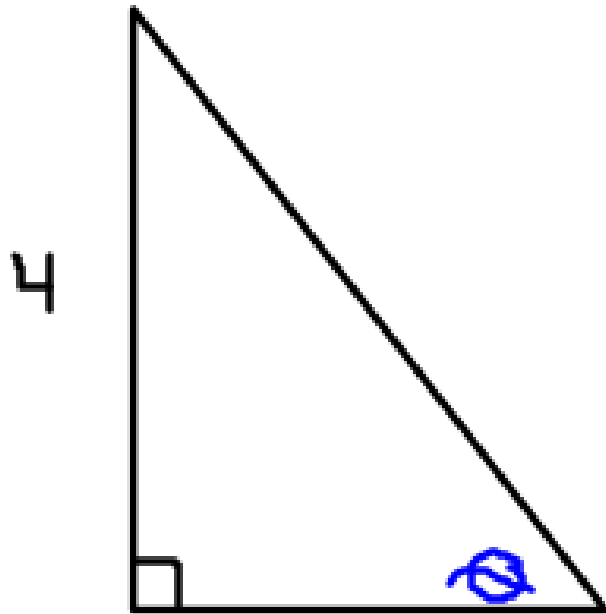
$$\tan \theta = \frac{7}{11}$$

$$\tan \theta = 0.6364$$

$$\theta = \tan^{-1}(0.6364)$$

$$\theta = 32.47^\circ$$

Your Turn - Find the tangent ratio for each of the given triangles. Then solve for the angle of elevation.



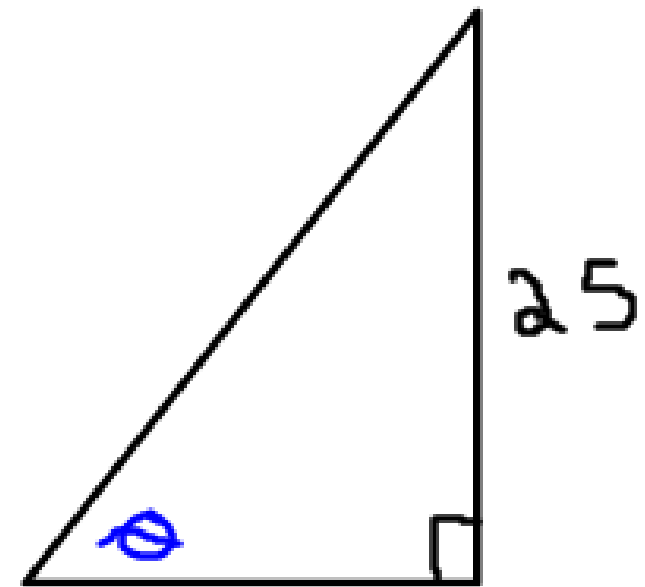
$$\tan \theta = \frac{\text{rise}}{\text{run}}$$

$$\tan \theta = \frac{4}{3}$$

$$\tan \theta = 1.3333$$

$$\theta = \tan^{-1}(1.3333)$$

$$\theta = 53.13^\circ$$



$$\tan \theta = \frac{\text{rise}}{\text{run}} \quad 24$$

$$\tan \theta = \frac{25}{24}$$

$$\tan \theta = 1.0417$$

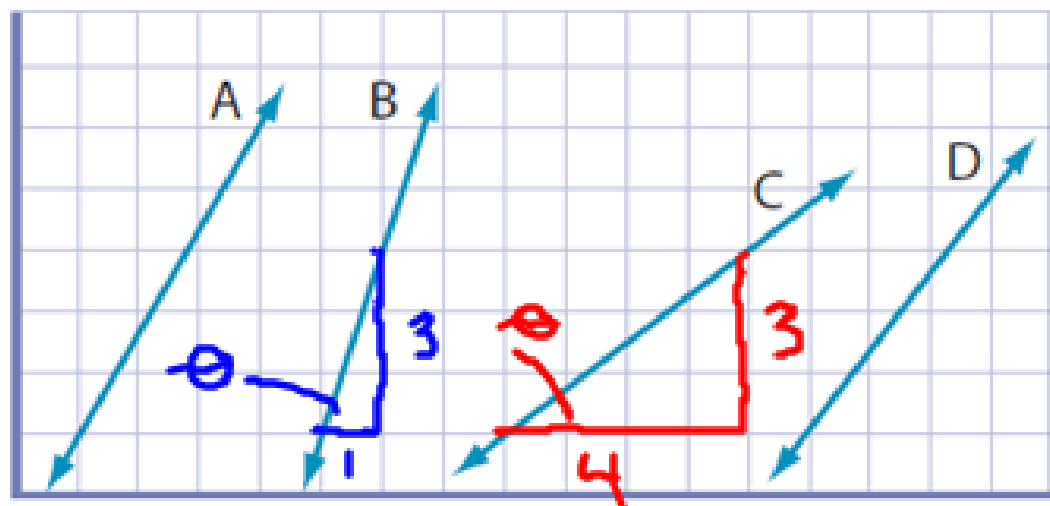
$$\theta = \tan^{-1}(1.0417)$$

$$\theta = 46.17^\circ$$

Find the angle of elevation of line A and C.

B is steepest

C is least steep.



Larger angle of elevation leads to a steeper line (greater slope).

$$\tan \theta = \frac{\text{rise}}{\text{run}}$$

$$\tan \theta = \frac{3}{1}$$

$$\tan \theta = 3$$

$$\theta = \tan^{-1}(3)$$

$$\theta = \underline{71.57^\circ}$$

$$\tan \theta = \frac{\text{rise}}{\text{run}}$$

$$\tan \theta = \frac{3}{4}$$

$$\tan \theta = 0.75$$

$$\theta = \tan^{-1}(0.75)$$

$$\theta = \underline{36.87^\circ}$$

Yanick and Emily plan to build a wheelchair ramp for their grandmother. They learn that outdoor ramps must have a slope close to 1:12 but not greater. This ensures that the person in the wheelchair can safely travel up and down the ramp.

- a) To start, they measure the space they have to build the ramp.
- The distance from the doorway straight down to the ground is 2 feet.
 - The walkway along the ground is 40 feet.

Do Emily and Yanick have enough space for a ramp that meets the safety rule?

- b) Once the ramp is built, what angle will the ramp make with the ground? Express your answer to the nearest degree.



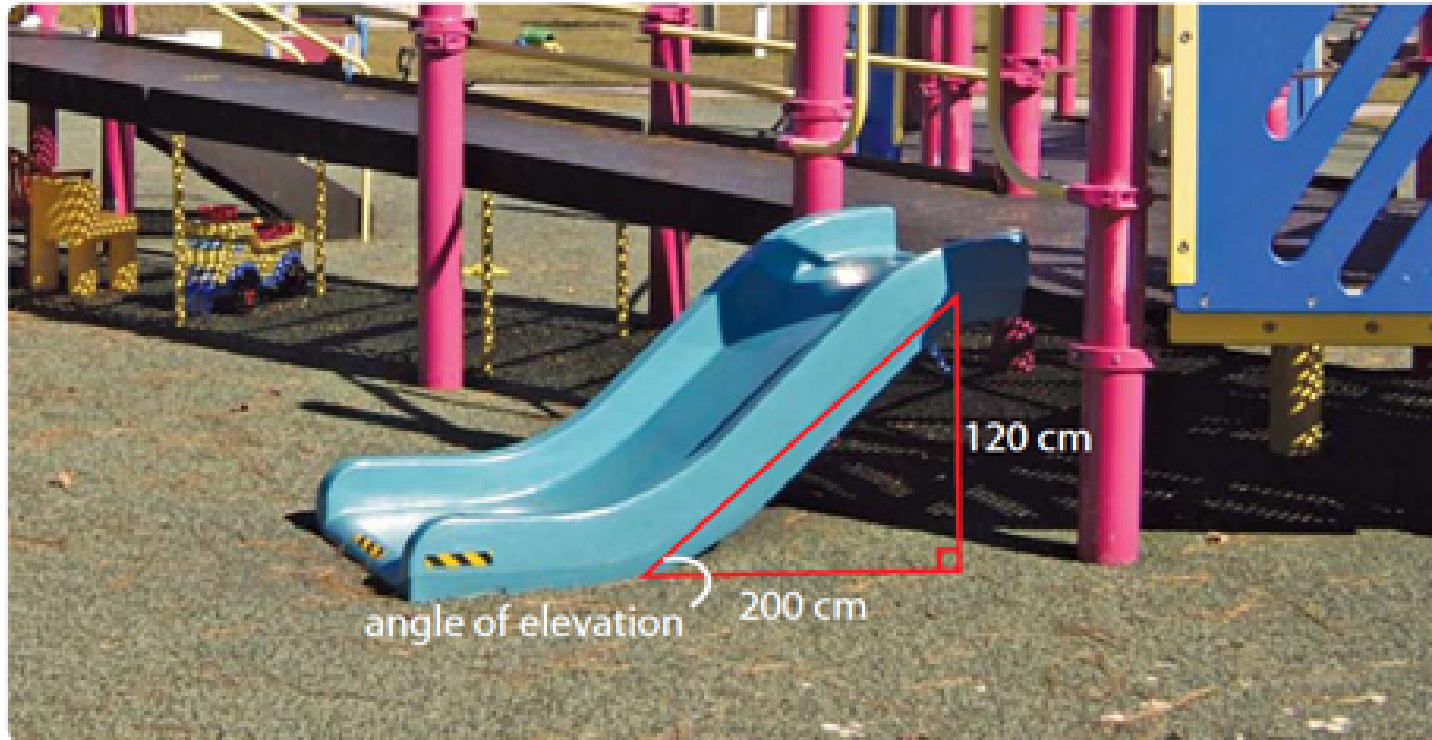
(a) $\text{slope} = \frac{\text{rise}}{\text{run}}$
 $\text{slope} = \frac{2 \text{ ft}}{40 \text{ ft}}$
 $\text{slope} = 0.05$

Max slope = $\frac{1}{12}$
 $0.05 < 0.0833$
 Yes, they have enough space.

(b) $\tan \theta = \frac{\text{rise}}{\text{run}}$
 $\tan \theta = \frac{2}{40}$
 $\tan \theta = 0.05$
 $\theta = \tan^{-1}(0.05)$
 $\theta = 2.86^\circ$
 $\theta = 3^\circ$

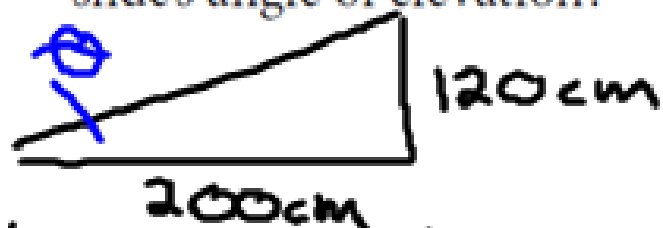
Your Turn

A local playground has a slide that reaches 200 cm along the ground. The top of the slide is 120 cm above the ground.



- Safety rules state that the slope of a slide cannot exceed 0.577. Does this slide comply with the rule? Explain.
- What angle does the slide make with the ground? Express your answer to the nearest degree.
- Safety rules state that the maximum angle of elevation of a slide is 30° . What is the difference between the maximum angle and this slide's angle of elevation?

- a) Safety rules state that the slope of a slide cannot exceed 0.577. Does this slide comply with the rule? Explain.
- b) What angle does the slide make with the ground? Express your answer to the nearest degree.
- c) Safety rules state that the maximum angle of elevation of a slide is 30° . What is the difference between the maximum angle and this slide's angle of elevation?



$$(a) \text{ slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = \frac{120\text{cm}}{200\text{cm}}$$

$$\text{Slope} = 0.6$$

$$0.6 > 0.577$$

The slope of the slide is larger than the regulations allow, so not safe.

$$(b) \tan \theta = \frac{\text{rise}}{\text{run}}$$

$$\tan \theta = \frac{120\text{cm}}{200\text{cm}}$$

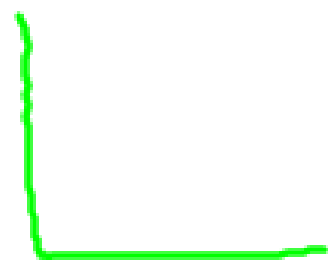
$$\tan \theta = 0.6$$

$$\theta = \tan^{-1}(0.6)$$

$$\theta = 30.96^\circ$$

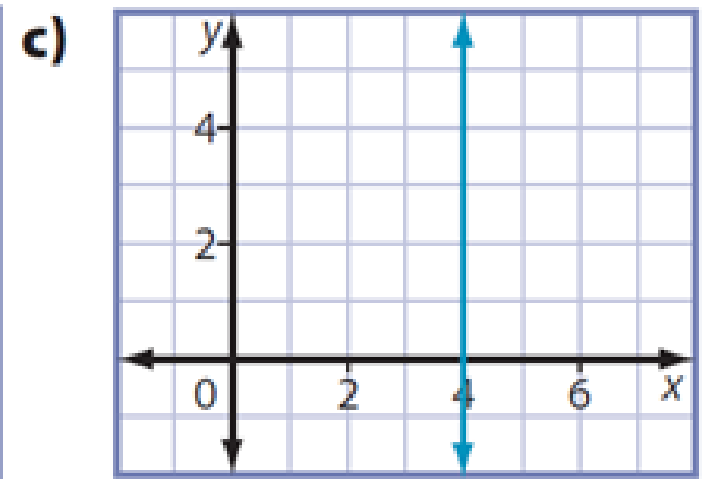
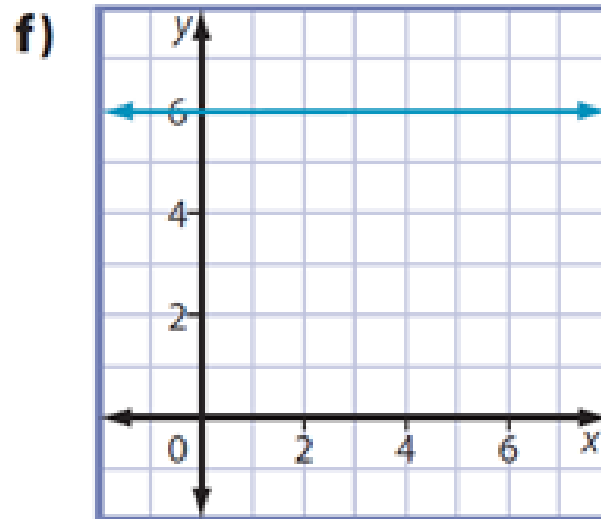
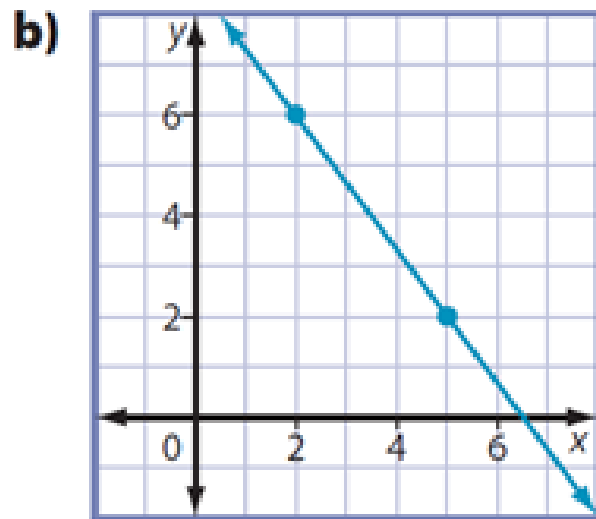
$$\theta \approx 31^\circ$$

(c) Angle of elevation is 1° too large, not safe.



Homework: Page 278-279 #1-7

3. For each graph, what is the measure of the angle of elevation to the nearest degree?



$\theta = 0^\circ$

$\theta = 90^\circ$