Reminder from notes 6.1

**Coterminal Angles in standard position have the same terminal side. They can be expressed as $\theta \pm 360°(n)$ or $\theta \pm 2\pi(n)$

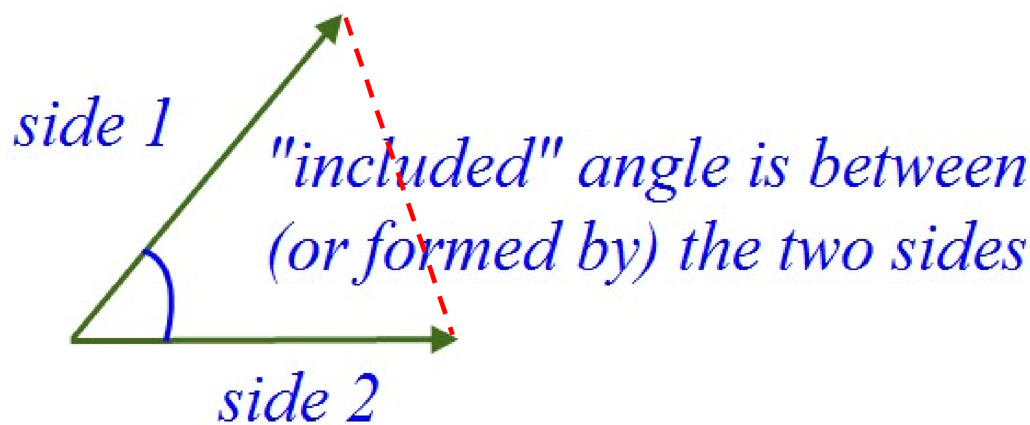
given angle ↑

↑ whole number

NOTES 6.3 ***Finding the area of a triangle when base and height are not given:***

$$A = \frac{1}{2}ab\sin\theta$$

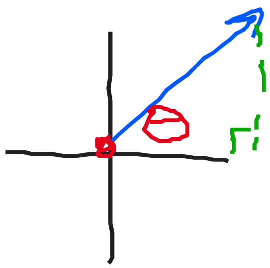
$$\mathbf{A} = \frac{1}{2}(\text{side}1)(\text{side}2)\bullet\sin(\text{included angle})$$

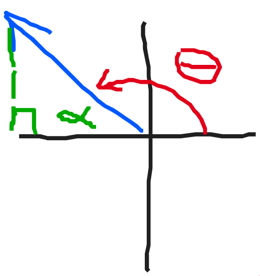


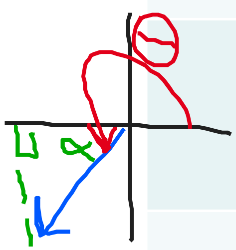
Notes: <u>Reference Angle</u>→ the **acute** angle formed by the **X-AXIS** and the terminal side of a given angle.

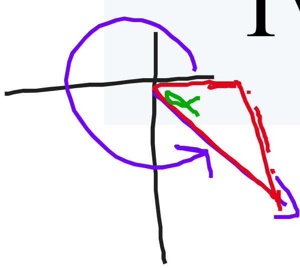
$0° \leq \theta < 360°$ $\qquad$ $0 \leq \theta < 2\pi$

QUADRANT	REFERENCE ANGLE (DEGREES) α	REFERENCE ANGLE (RADIANS) α
I	θ	θ
II	180° – θ	π – θ
III	θ –180°	θ – π
IV	360° – θ	2π – θ



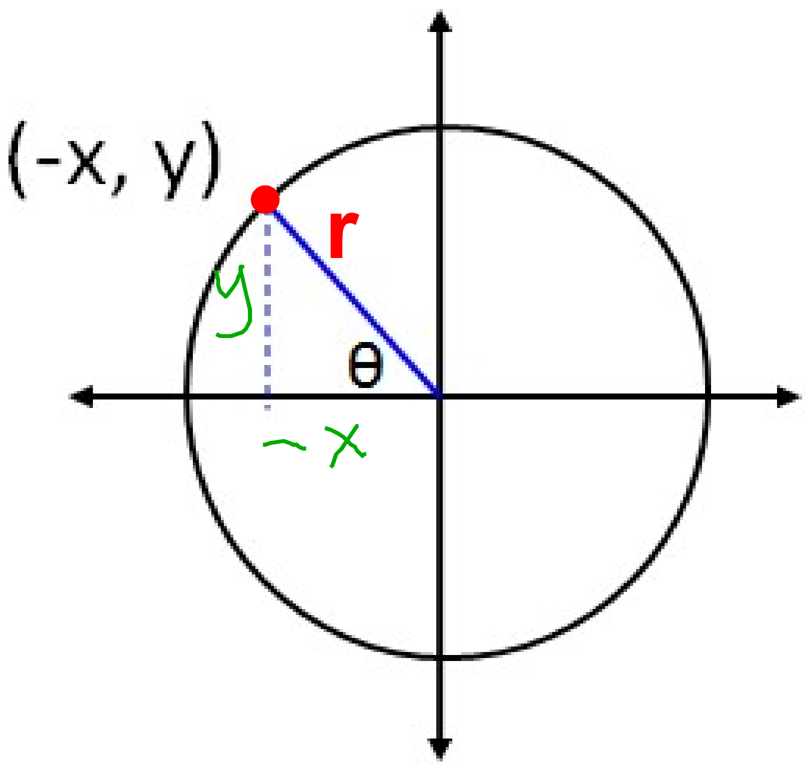






Notes 6.3:

Some trig ratios will be negative if the triangle is in Quadrant II, III, or IV



Quadrant II values

$\frac{opp}{hyp}$ $\sin\theta = \frac{y}{r} = +$

$\cos\theta = \frac{-x}{r} = -$

$\tan\theta = \frac{y}{-x} = -$

Notes: 6.3 Values of the trig functions in all quadrants

$\frac{\pi}{2}$ 90°

$\csc\theta = +$	$\boxed{\sin\theta = +}$
$\sec\theta = -$	$\cos\theta = -$
$\cot\theta = -$	$\tan\theta = -$

II

$\sin\theta = +$
$\cos\theta = +$
$\tan\theta = +$

I

0

π 180°

$\sin\theta = -$
$\cos\theta = -$
$\boxed{\tan\theta = +}$

III

IV

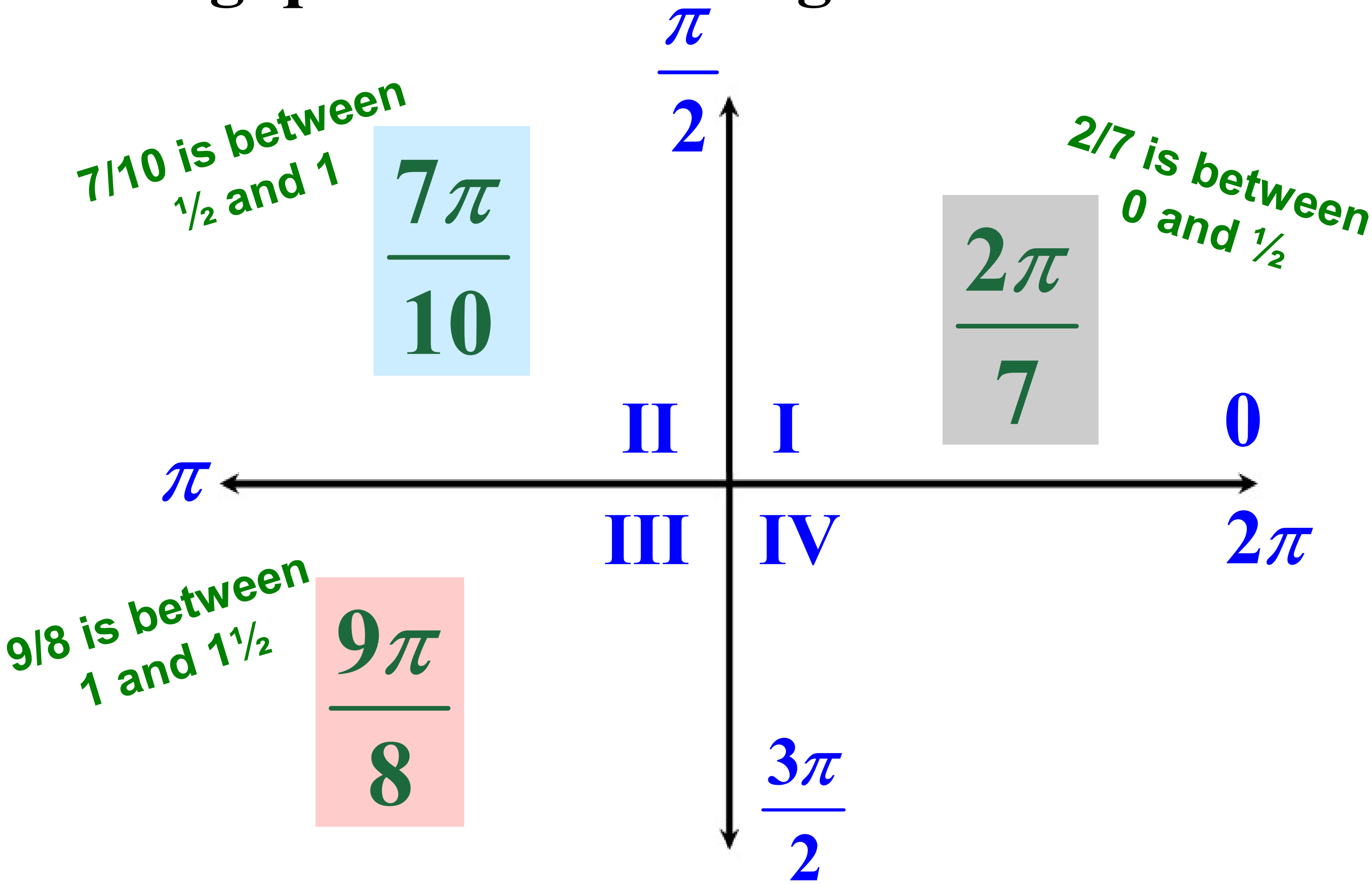
$\sin\theta = -$
$\boxed{\cos\theta = +}$
$\tan\theta = -$

2π 360°

$\frac{3\pi}{2}$ 270°

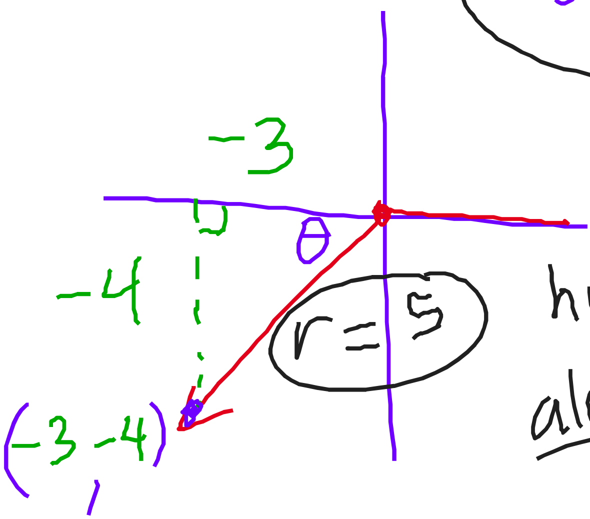
Notes

Determining quadrants for angles in radians:



Find the values of the 6 trig functions of θ from the information given.

48. $\tan\theta = \frac{4 \text{ opp}}{3 \text{ adj}}$, θ in Quadrant III



(r) hypotenuse always positive

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

$\sin\theta = -\frac{4}{5}$ $\csc\theta = \frac{5}{-4}$

$\cos\theta = -\frac{3}{5}$ $\sec\theta = \frac{5}{-3}$

Find the reference angle for the given angle:

5. (*a*) **120°** (*b*) **200°** (*c*) **285°**

(a) II

$$\begin{array}{r} 180 \\ -120 \\ \hline 60° \end{array}$$

ref angle

(b) III

$$\begin{array}{r} 200 \\ -180° \\ \hline 20° \end{array}$$

(c) IV

$$\begin{array}{r} 360 \\ -285 \\ \hline 75° \end{array}$$

QUADRANT	REFERENCE ANGLE (DEGREES)	REFERENCE ANGLE (RADIANS)
1	θ	θ
2	$180° - \theta$	$\pi - \theta$
3	$\theta - 180°$	$\theta - \pi$
4	$360° - \theta$	$2\pi - \theta$

Find the reference angle for the given angle:

6. (*a*) **175°** (*b*) **310°** (*c*) **730°** $-360(2)$

$730-720=10°$

I

ref angle $=\boxed{10°}$

Coterminal Angles

$\theta \pm 360°(n)$ or $\theta \pm 2\pi(n)$

	$0° \le \theta < 360°$	$0 \le \theta < 2\pi$
QUADRANT	**REFERENCE ANGLE (DEGREES)**	**REFERENCE ANGLE (RADIANS)**
1	θ	θ
2	$180° - \theta$	$\pi - \theta$
3	$\theta - 180°$	$\theta - \pi$
4	$360° - \theta$	$2\pi - \theta$

CHECK EVEN ANSWERS

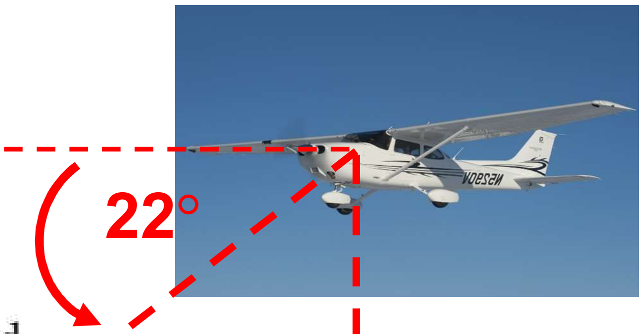
6. (a) $\mathbf{5°}$ (b) $\mathbf{50°}$ (c) $\mathbf{10°}$

8. (a) $\mathbf{81°}$ (b) $\mathbf{19°}$ (c) $\mathbf{1°}$

10. (a) $\dfrac{\pi}{6}$ (b) $\dfrac{\pi}{9}$ (c) $\dfrac{2\pi}{7}$

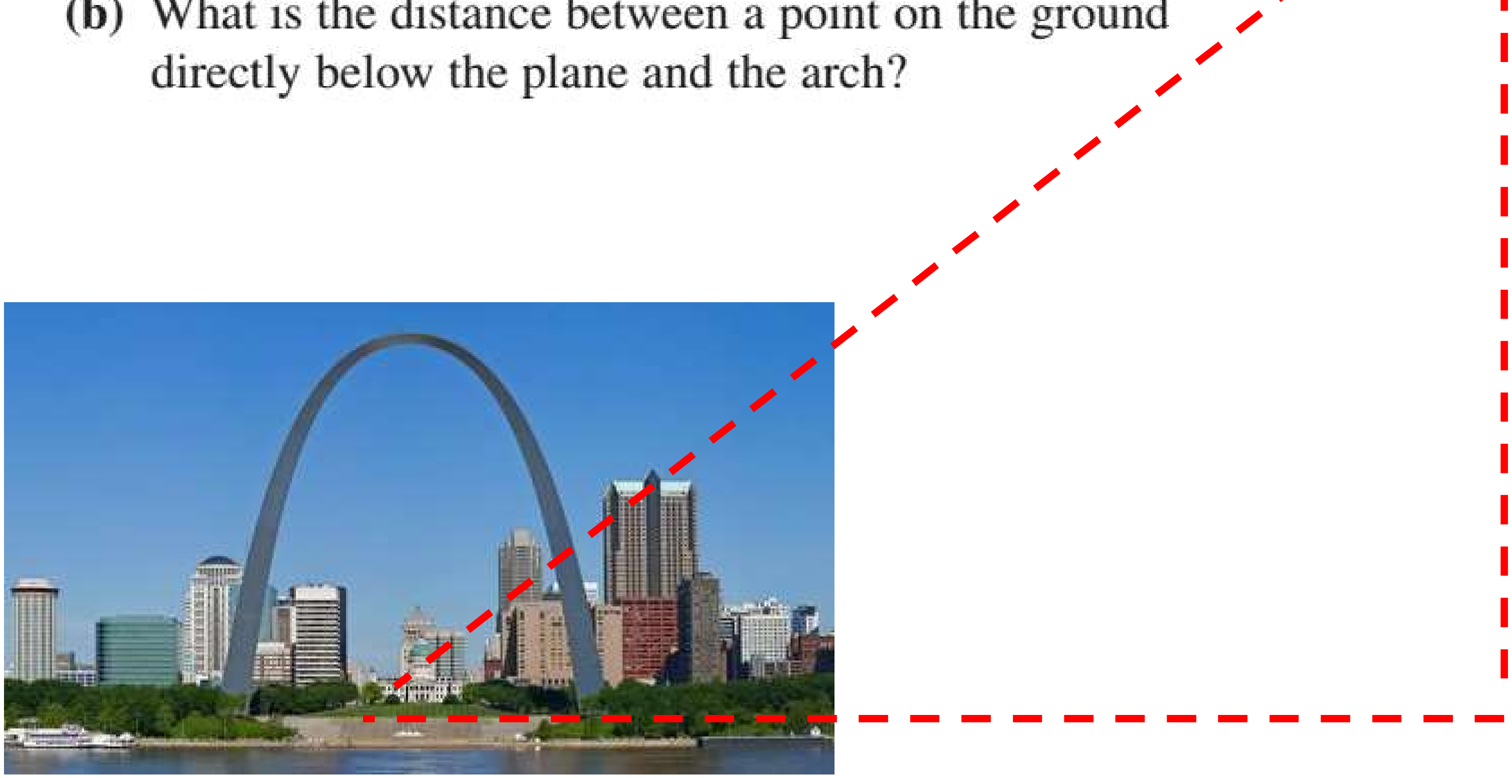
The following diagrams may help you solve the word problems from yesterday's work (6.2 part 2)

54. Gateway Arch A plane is flying within sight of the Gateway Arch in St. Louis, Missouri, at an elevation of 35,000 ft. The pilot would like to estimate her distance from the Gateway Arch. She finds that the angle of depression to a point on the ground below the arch is 22°.



(a) What is the distance between the plane and the arch?

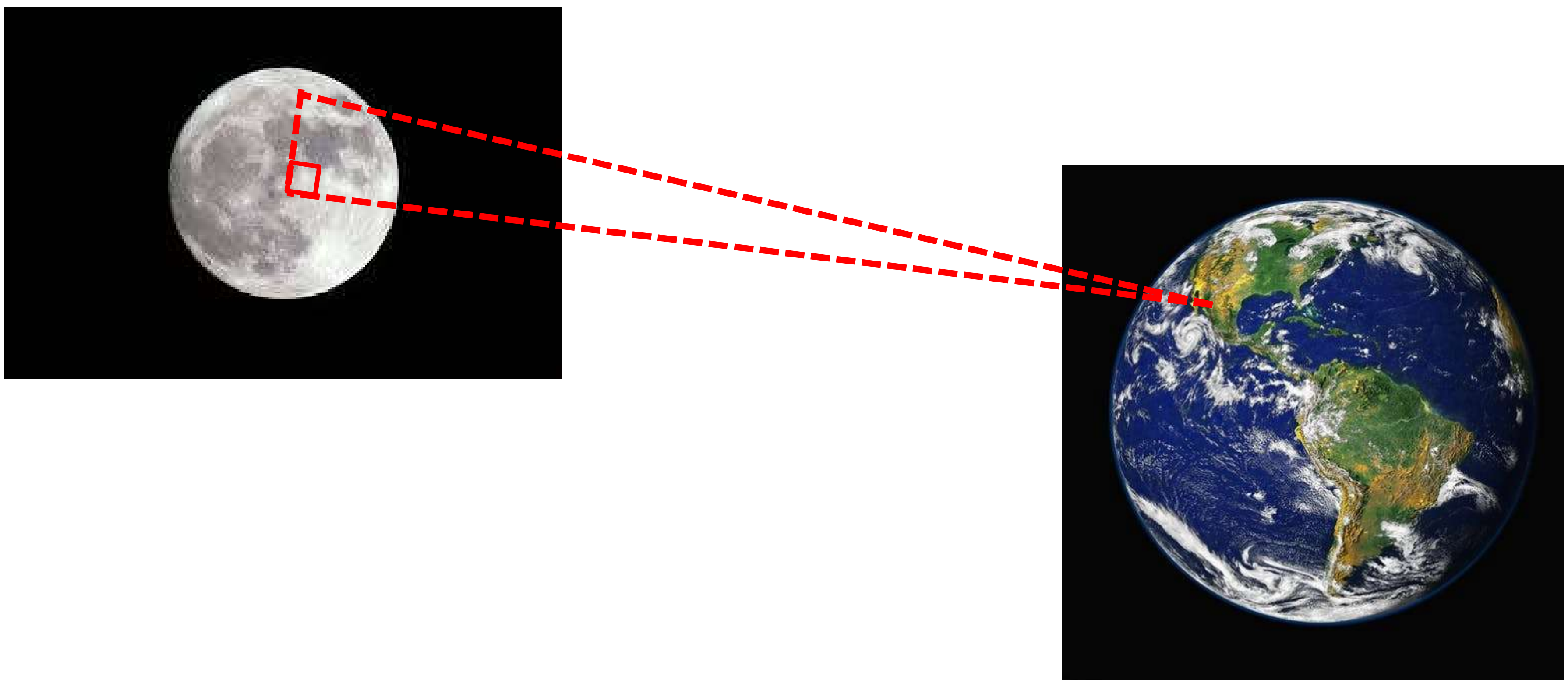
(b) What is the distance between a point on the ground directly below the plane and the arch?



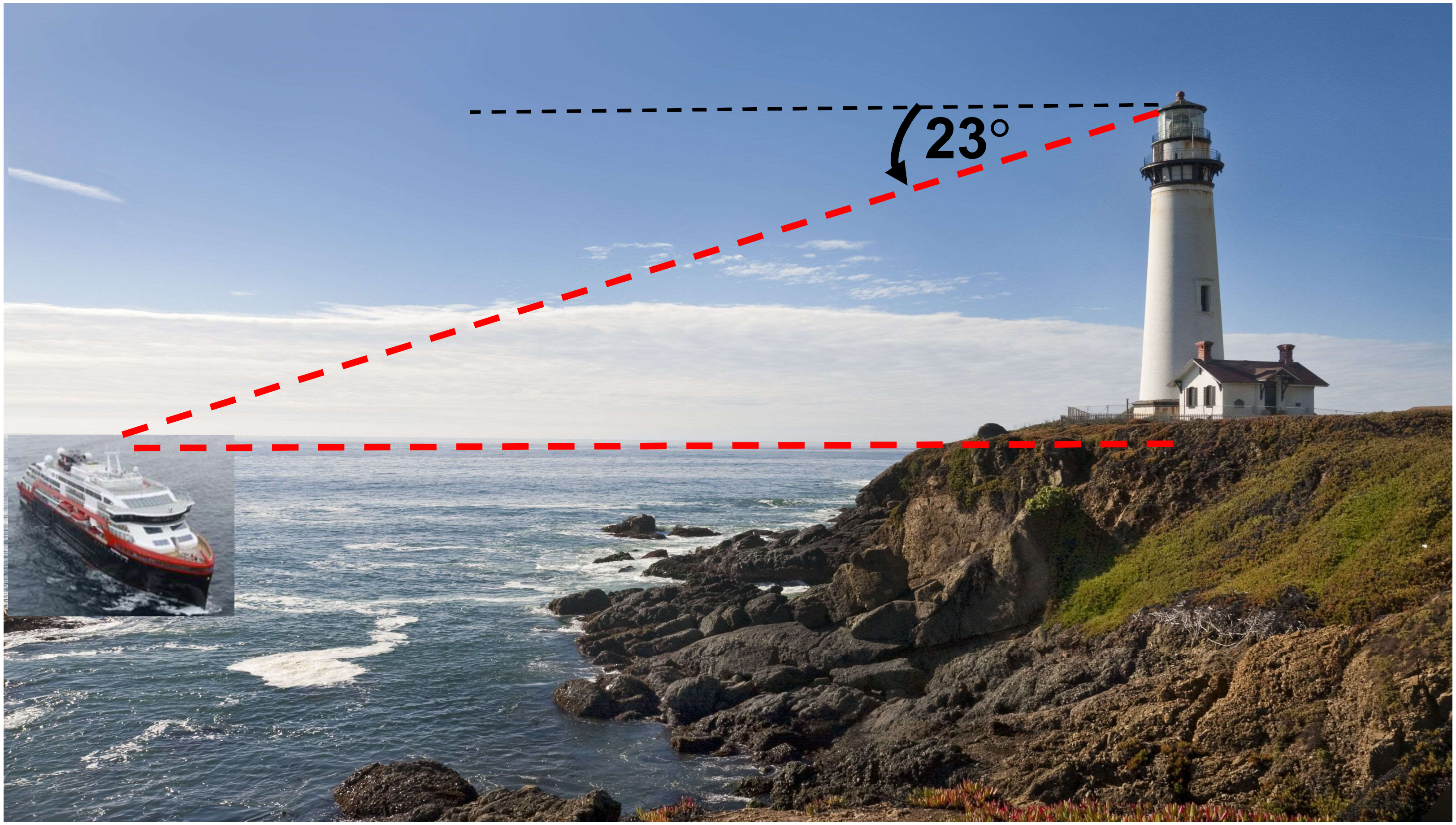
55. Deviation of a Laser Beam A laser beam is to be directed toward the center of the moon, but the beam strays 0.5° from its intended path.

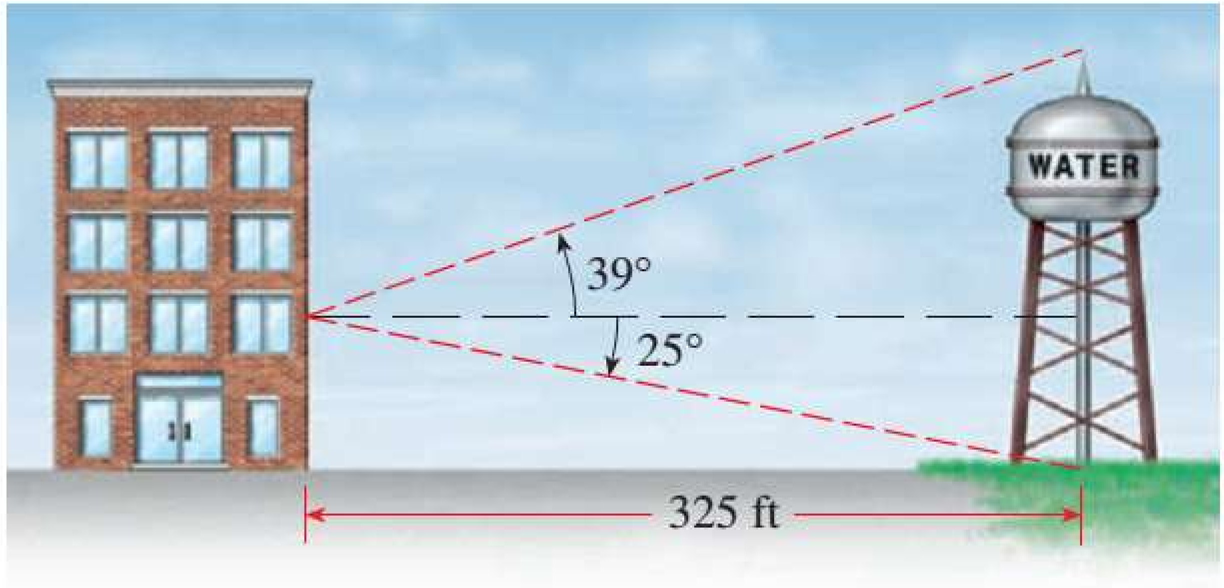
(a) How far has the beam diverged from its assigned target when it reaches the moon? (The distance from the earth to the moon is 240,000 mi.)

(b) The radius of the moon is about 1000 mi. Will the beam strike the moon?



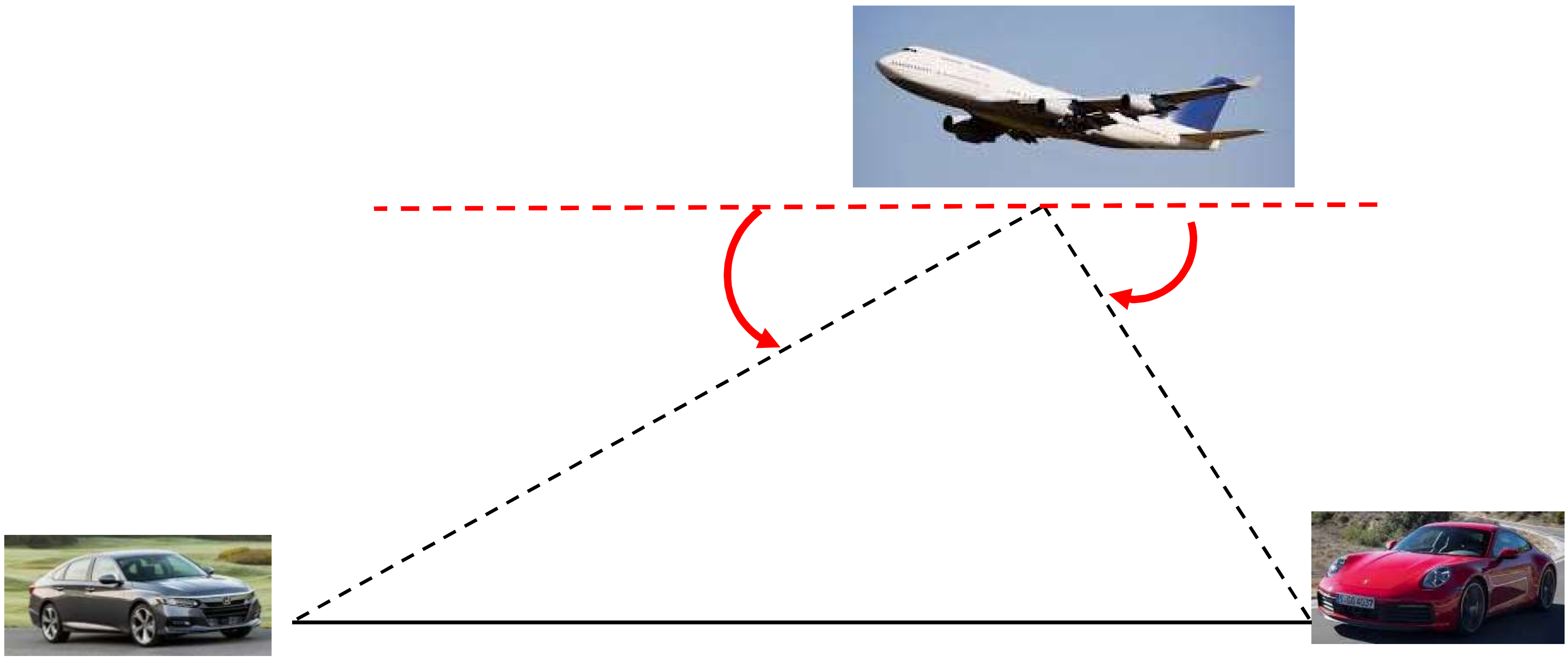
56. Distance at Sea From the top of a 200-ft lighthouse, the angle of depression to a ship in the ocean is 23°. How far is the ship from the base of the lighthouse?



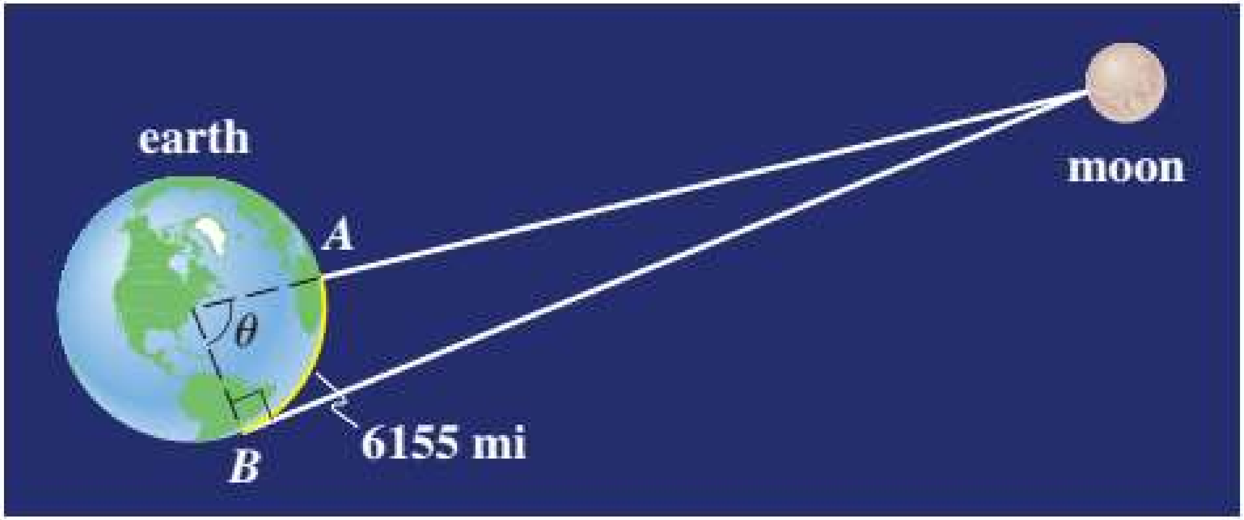


61. Height of a Tower A water tower is located 325 ft from a building (see the figure). From a window in the building, an observer notes that the angle of elevation to the top of the tower is 39° and that the angle of depression to the bottom of the tower is 25°. How tall is the tower? How high is the window?

62. Determining a Distance An airplane is flying at an elevation of 5150 ft, directly above a straight highway. Two motorists are driving cars on the highway on opposite sides of the plane. The angle of depression to one car is 35°, and that to the other is 52°. How far apart are the cars?



See notes 6.1 for arc length equation



68. Distance to the Moon To find the distance to the sun as in Exercise 67, we needed to know the distance to the moon. Here is a way to estimate that distance: When the moon is seen at its zenith at a point A on the earth, it is observed to be at the horizon from point B (see the following figure). Points A and B are 6155 mi apart, and the radius of the earth is 3960 mi.

(a) Find the angle θ in degrees.

(b) Estimate the distance from point A to the moon.