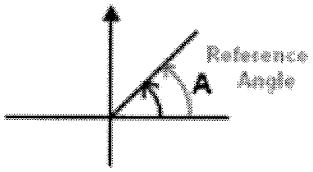
Math 20-1

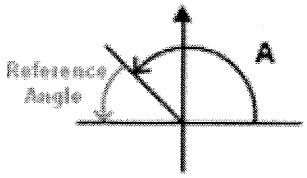
KEY

Lxx – Worksheet – 2.1 Angles in Standard Position

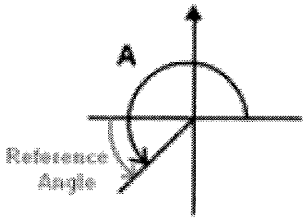
Part 1 – Unit Circle and Special Right Triangles



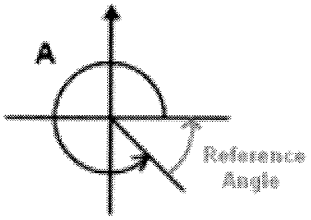
1st Quadrant



2nd Quadrant

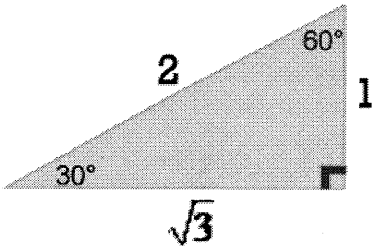


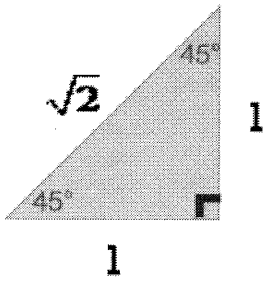
3rd Quadrant



4th Quadrant

Evaluating Functions of a 30°, 45°, or 60° Angle





$\sin 30° = \frac{1}{2}$ $\sin 60° = \frac{\sqrt{3}}{2}$ $\sin 45° = \frac{\sqrt{2}}{2}$

$\cos 30° = \frac{\sqrt{3}}{2}$ $\cos 60° = \frac{1}{2}$ $\sin 45° = \frac{\sqrt{2}}{2}$

$\tan 30° = \frac{\sqrt{3}}{3}$ $\tan 60° = \sqrt{3}$ $\sin 45° = 1$

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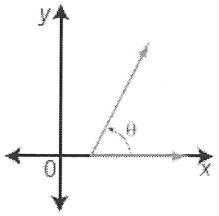
Part 2 – Textbook Questions

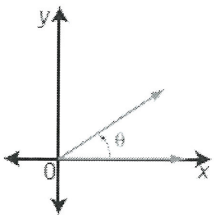
Pg 83 #1: Is each angle, θ, in standard position? Explain.

a)



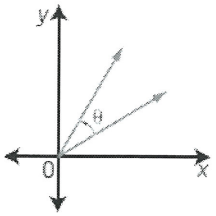
No. Vertex is not at the origin.

b)



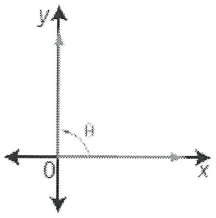
Yes!

c)



No. Angle should be measured from x-axis.

d)

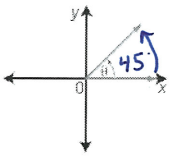


Yes!

Pg 83 #2: Without measuring, match each angle with a diagram of the angle in standard position.

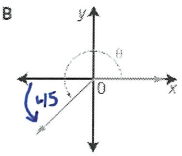
a) 150° - F
b) 180° - C
c) 45° - A
d) 320° - D
e) 215° - B
f) 270° - E

A



C

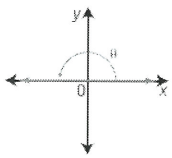
B



180 + 45 = 225°

E

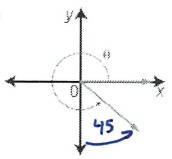
C



180°

B

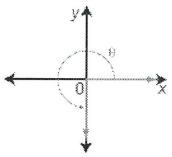
D



270 + 45 = 315°

D

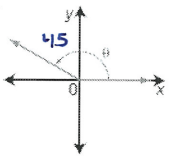
E



270°

F

F



90 + 45 = 135°

A

Pg 83 #3: In which quadrant does the terminal arm of each angle in standard position lie?

a. 48^0 - I

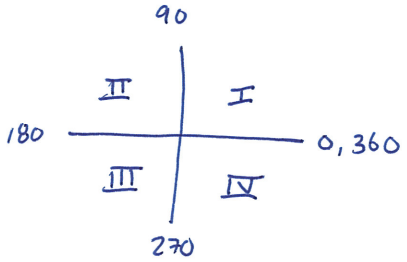
b. 300^0 - IV

c. 185^0 - III

d. 75^0 - I

e. 220^0 - III

f. 160^0 - II



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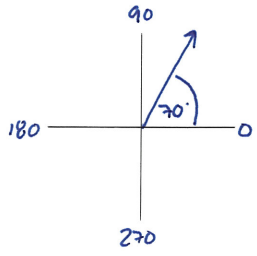
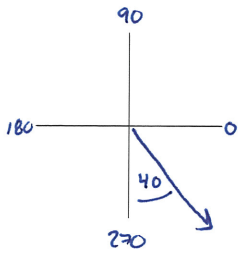
Pg 83 #4: Sketch an angle in standard position with each given measure.

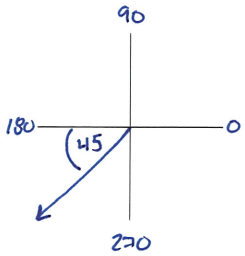
a. 70^0



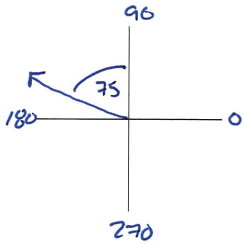
b. $310^0 = 270 + 40$



c. $225^0 = 180 + 45$

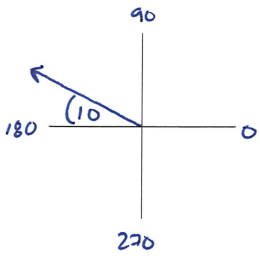


d. $165^0 = 90 + 75$



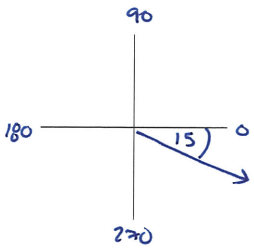
Pg 83 #5: What is the reference angle for each angle in standard position?

a. 170^0



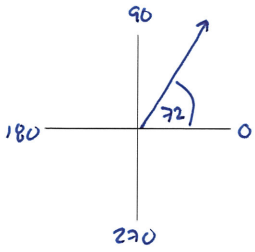
10°

b. 345^0



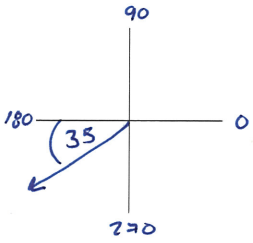
15°

c. 72^0



72°

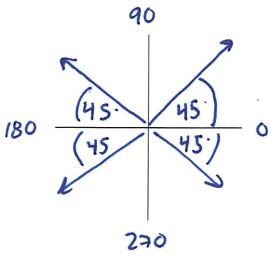
d. 215^0



35°

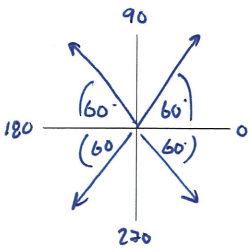
Pg 83 #6: Determine the measure of the three other angles in standard position, $0^0 < \theta < 360^0$, that have a reference angle of

a. 45^0



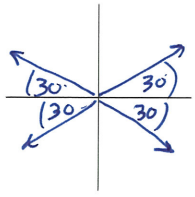
135°, 225°, 315°

b. 60^0



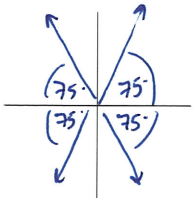
120°, 240°, 300°

c. 30^0



150°, 210°, 330°

d. 75^0



105°, 255°, 285°

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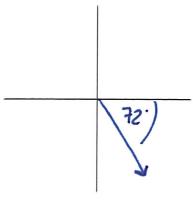
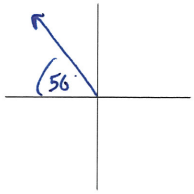
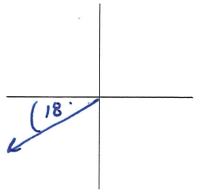
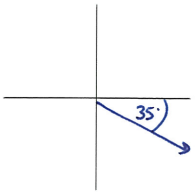
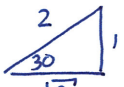
Pg 83 #7: Determine the measure of each angle in standard position given its reference angle and the quadrant in which the terminal arm lies.

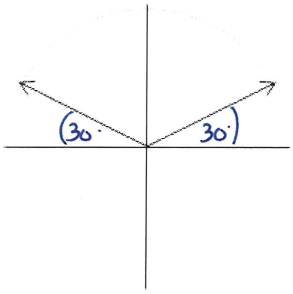
Reference Angle	72^0	56^0	18^0	35^0
Quadrant	IV	II	III	IV
Diagram				
Angle in Standard Position	288°	124°	198°	325°

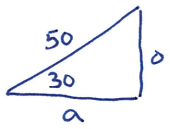
Pg 83 #8: Complete the table without using a calculator. Express each ratio using exact values.



θ	Sin θ	Cos θ	Tan θ
30^0	$\sin 30 = \frac{o}{h} = \frac{1}{2}$	$\cos 30 = \frac{a}{h} = \frac{\sqrt{3}}{2}$	$\tan\theta = \frac{o}{a} = \frac{1}{\sqrt{3}}$
45^0	$\sin 45 = \frac{o}{h} = \frac{1}{\sqrt{2}}$	$\cos 45 = \frac{1}{\sqrt{2}}$	$\tan 45 = \frac{1}{1}$
60^0	$\sin 60 = \frac{o}{h} = \frac{\sqrt{3}}{2}$	$\cos 60 = \frac{1}{2}$	$\tan 60 = \frac{\sqrt{3}}{1}$

Pg 83 #11: A windshield wiper has a length of 50 cm. The wiper rotates from its resting position at 30^0, in standard position, to 150^0. Determine the exact horizontal distance that the tip of the wiper travels in one swipe.

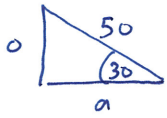




$\cos 30 = \frac{a}{h}$ where $\cos 30 = \frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2} = \frac{a}{h}$ or $\frac{\sqrt{3}}{2} = \frac{a}{50}$

$a = \frac{50\sqrt{3}}{2}$ or $25\sqrt{3}$



$\cos 30 = \frac{a}{h}$

$\frac{\sqrt{3}}{2} = \frac{a}{50}$

$a = 25\sqrt{3}$

So total horizontal distance $= 25\sqrt{3} + 25\sqrt{3}$

$= 50\sqrt{3}$ cm

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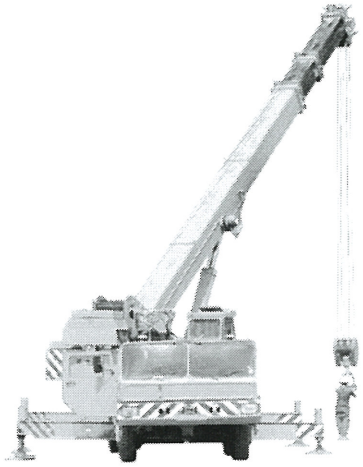
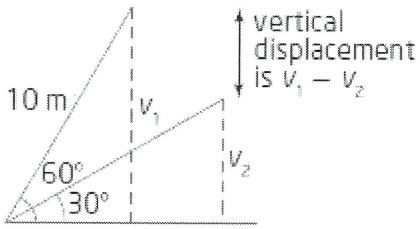
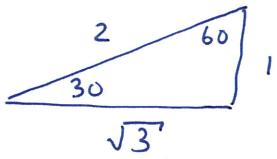
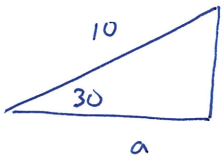
Pg 83 #13: A 10-m boom lifts material onto a roof in need of repair. Determine the exact vertical displacement of the end of the boom when the operator lowers it from 60^0 to 30^0.





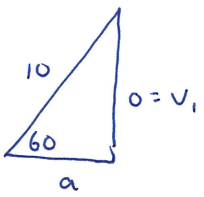




$\sin 30 = \frac{o}{h}$ where $\sin 30 = \frac{1}{2}$

$\frac{1}{2} = \frac{V_2}{10}$

$V_2 = 5$



$\sin 60 = \frac{o}{h}$ where $\sin 60 = \frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2} = \frac{V_1}{10}$

$V_1 = 5\sqrt{3}$

Vertical displacement $= V_1 - V_2$

$= 5\sqrt{3} - 5$ m

$= 5(\sqrt{3} - 1)$ m

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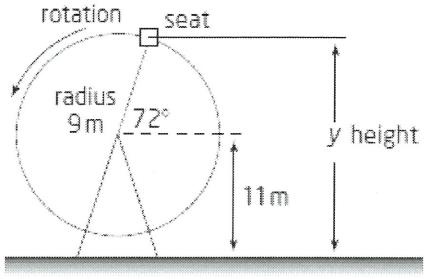
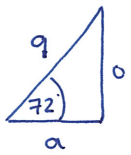
Pg 83 #20: Carl and a friend are on the Antique Ferris Wheel Ride at Callaway Park in Calgary. The ride stops to unload the riders. Carl's seat forms an angle of 72^0 with a horizontal axis running through the center of the Ferris wheel.

a. If the radius of the Ferris wheel is 9 m and the center of the wheel is 11 m above the ground, determine the height of Carl's seat above the ground.
b. Suppose the Ferris wheel travels at four revolutions per minute and the operator stops the ride in 5 s.
    i. Determine the angle in standard position of the seat that Carl is on at this second stop. Consider the horizontal central axis to be the x-axis.
    ii. Determine the height of Carl's seat at the second stop.



(A)



$\sin 72 = \frac{o}{h}$

$\sin 72 = \frac{o}{9}$

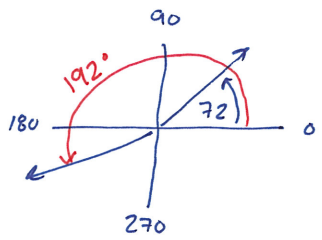
$opp = 8.56\ m$

Total height = $11\ m + 8.56\ m$

$= 19.56\ m$

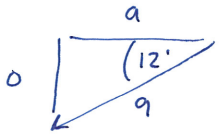
(B)(i) $\frac{4 \text{ revolutions}}{\text{minute}} = \frac{4(360^\circ)}{60\ sec} = \frac{1440\ deg}{60\ sec} = 24\ \frac{deg}{sec}$

So $\frac{24\ deg}{sec} \cdot 5s = 120\ deg.$



So $\boxed{192\ deg}$

(ii)



$\sin\theta = \frac{o}{h}$

$\sin 12 = \frac{o}{9}$

$opp = 1.87\ m$

Height = $11\ m - 1.87\ m = \boxed{9.13\ m}$