Terminal Side

Initial side

-135°

+

−

II   I
III   IV

coterminal angles
terminate same place.

$-90°$ $270°$
$+360$
$630°$

Ex 2 Find 2 positive coterminal angles and 2 negative coterminal angles for the angles stated:

a) $40°$

$360 + 40 = 400°$
$40 - 360 = -320°$
$-320° - 360° = -680°$
$400° + 360 = 760°$

b) $-100°$

$-100 + 360 = 260°$
$-100 - 360 = 460°$
$260 + 360 = 620°$
$-460 - 360 = -820°$

Which coterminal angles, θ, are $-360° \leq \theta \leq 360°$?

a) $40°$ and $-320°$

b) $-100°$ and $260°$

II   I   Coterminal Angles
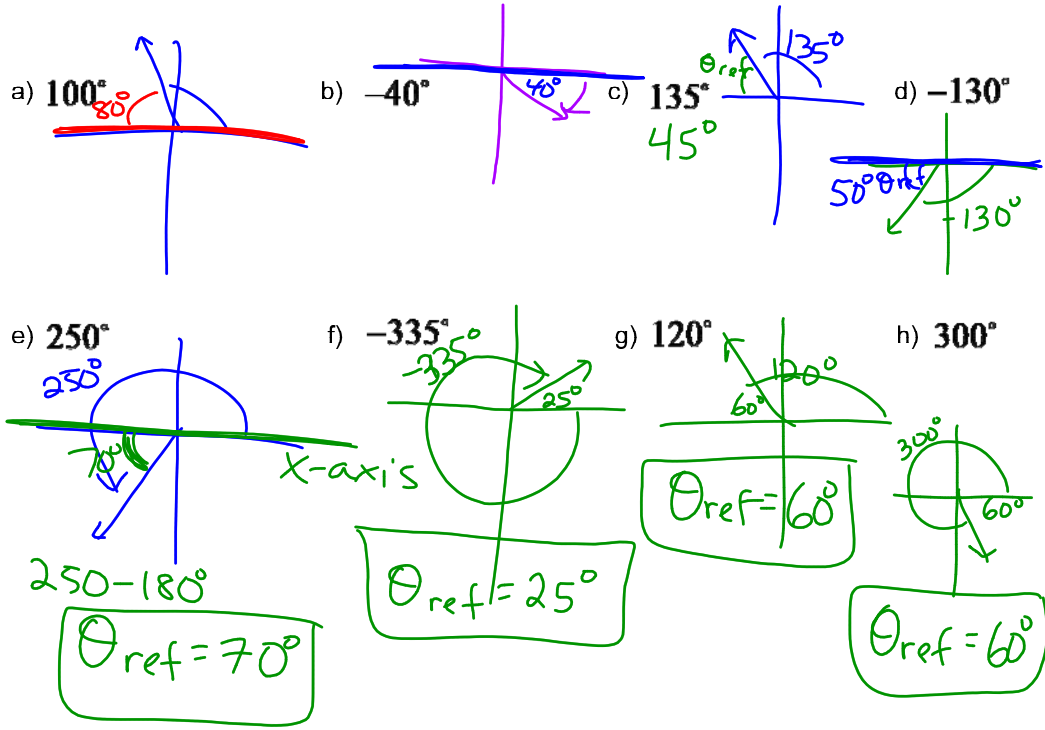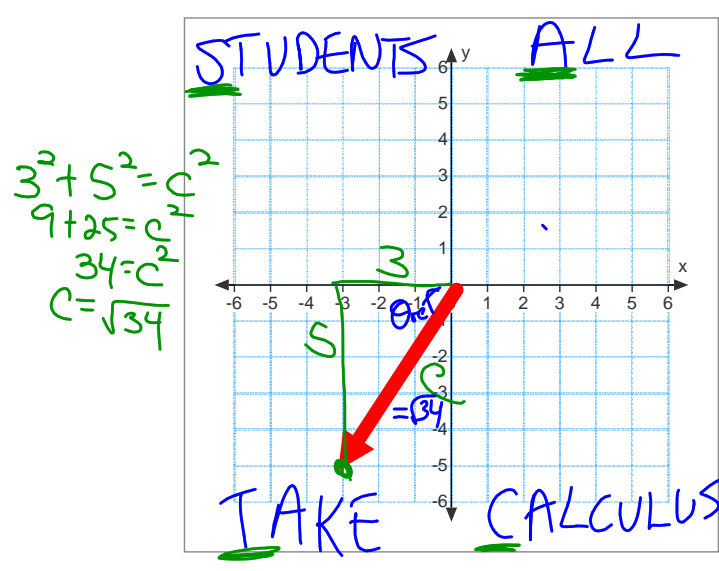III   IV
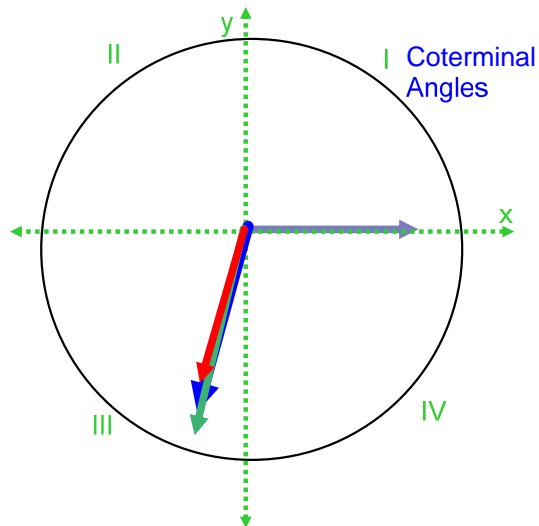
★★★ <u>Reference Angles</u> (θ_{ref}): is the **POSITIVE ACUTE** angle formed by

the terminal side of θ and the nearest part of the **x-axis.**

Reference Angles

$100°$
ref ∠ = $80°$

Reference angle
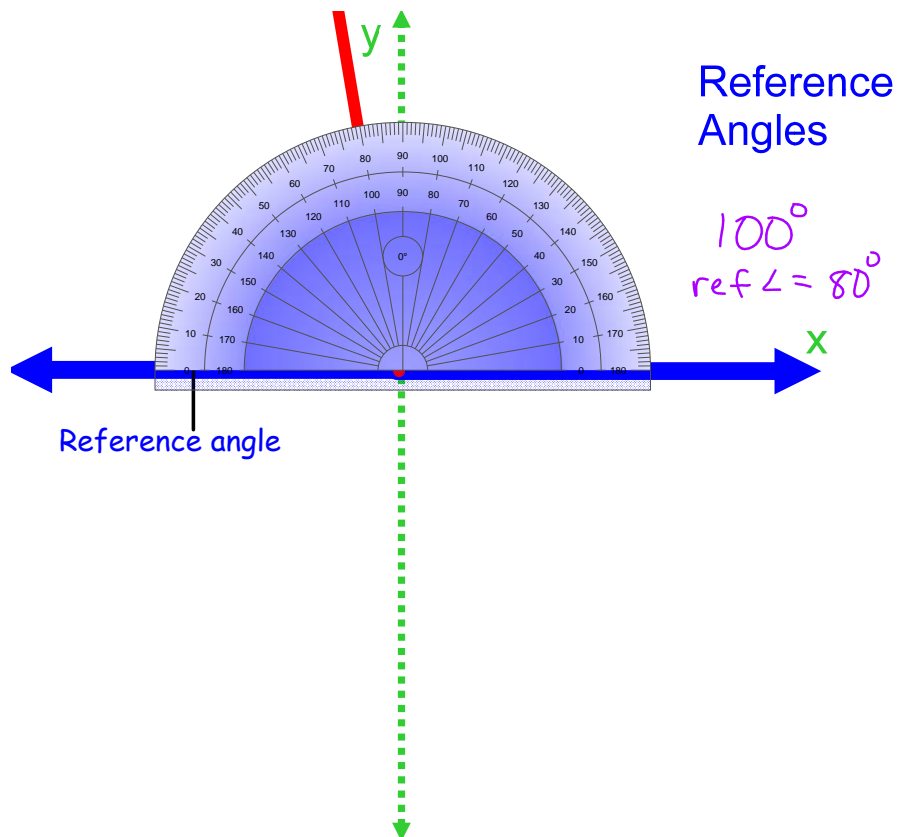
Ex 3 Find the angle, θ_{ref}, for each angle: (remember it has to be positive and acute)

a) $100°$ $80°$

b) $-40°$ $40°$

c) $135°$ θ_{ref} $135°$
$45°$

d) $-130°$ $50°$ θ_{ref} $-130°$

e) $250°$ $250°$ $70°$
$250-180°$
$\boxed{\theta_{ref}=70°}$

f) $-335°$ $-335°$ $25°$ x-axis
$\boxed{\theta_{ref}=25°}$

g) $120°$ $120°$ $60°$
$\boxed{\theta_{ref}=60°}$

h) $300°$ $300°$ $60°$
$\boxed{\theta_{ref}=60°}$

Ex 4: Let P(-3,-5) be on the terminal side of θ in standard postion.
Find the **EXACT** values of the six trig functions.

STUDENTS ALL

$3^2+5^2=C^2$
$9+25=C^2$
$34=C^2$
$C=\sqrt{34}$

3
θ_{ref}
S
C
$=\sqrt{34}$

TAKE   CALCULUS

Exact Values
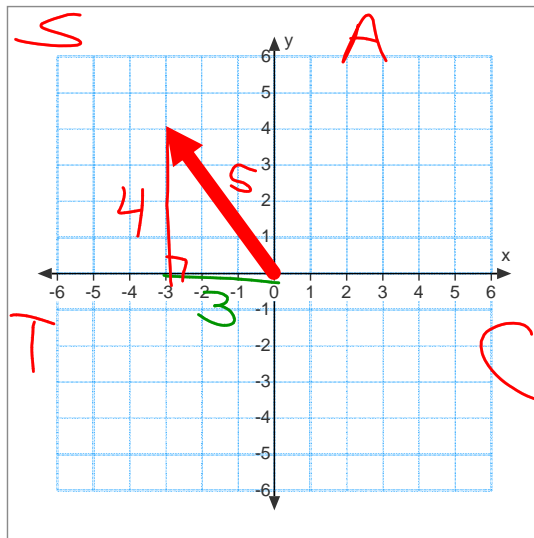SOH CAH TOA

$\sin\theta=\frac{-5}{\sqrt{34}}$ $\csc\theta=\frac{-\sqrt{34}}{5}$

$\cos\theta=\frac{-3}{\sqrt{34}}$ $\sec\theta=\frac{-\sqrt{34}}{3}$

$\tan\theta=\frac{5}{3}$ $\cot\theta=\frac{3}{5}$

yes, simplify radicals!

Exact Values

Ex 5: The terminal side of θ in standard position is in Quadrant II and $\cos\theta = -\dfrac{3}{5} \begin{array}{l}\text{adj}\\\text{hyp}\end{array}$
Find the EXACT values of the other 5 trig functions.

S   A

4   5

3

T   C

$\sin\theta = \dfrac{4}{5}$ $\csc\theta = \dfrac{5}{4}$

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

$\tan\theta = \dfrac{-4}{3}$ $\cot\theta = \dfrac{-3}{4}$

Exact Values

Ex 6: The Terminal side of θ in standard position is in Quadrant IV and $\cot\theta = -1.2$

Find $\cos\theta$

$\cot\theta = -1\dfrac{2}{10}$

$\cot\theta = -\dfrac{12}{10}$

$\cot\theta = -\dfrac{6}{5}$

$\tan\theta = -\dfrac{5}{6} \begin{array}{l}\text{opp}\\\text{adj}\end{array}$

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

$\cos\theta = \dfrac{6}{\sqrt{61}} \cdot \dfrac{\sqrt{61}}{\sqrt{61}}$

$\boxed{\cos\theta = \dfrac{6\sqrt{61}}{61}}$

S | 6 | A

θ_{ref}

T $\sqrt{61} = C$ 5   C

$5^2 + 6^2 = C^2$
$25 + 36 = C^2$
$61 = C$
$\sqrt{61} = C$