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Co-terminal and Reference Angles

Angles in standard position with the same terminal side are co-terminal angles.
Co-terminal angles are important because the trigonometric ratios regarding co-terminal angles are equivalent.

Example: Give two co-terminal angles for each given angle, one positive and one negative.

1. 65°

$65+360=425°$

$65-360=-295°$

2. 540°

$540-360=180°$

$540-360-360=-180°$

3. $\frac{13\pi}{18}$

$\frac{13\pi}{18}+2\pi=\frac{49\pi}{18}$

$\frac{13\pi}{18}-2\pi=-\frac{23\pi}{18}$

4. $\frac{14\pi}{9}$

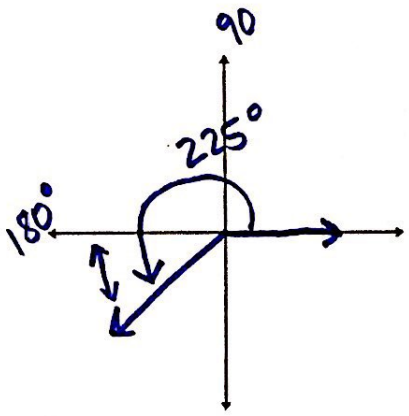
$\frac{14\pi}{9}+2\pi=\frac{32\pi}{9}$

$\frac{14\pi}{9}-2\pi=-\frac{4\pi}{9}$

A reference angle is the angle that the terminal side makes with the "closest" part of the x-axis. Reference angles are important because they allow us to utilize right triangle trigonometry on the rotational system. To determine a reference angle for an angle in standard position, compare the angle's measure to the closest x-axis. You will either need to subtract using a multiple of 180 or π if you are in quadrant II or III or multiple of 360 or 2π if you are in quadrant IV.

Example: Sketch and find the reference angles for each angle.

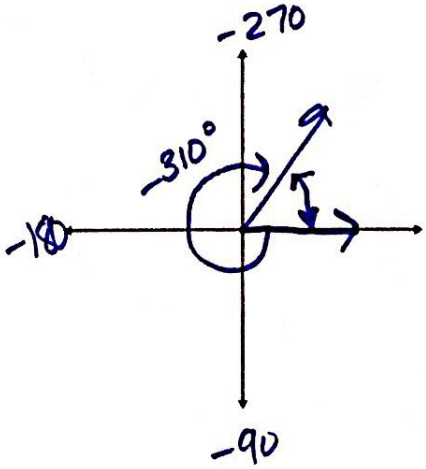
5. 225°



Ref. $225-180$

$45°$

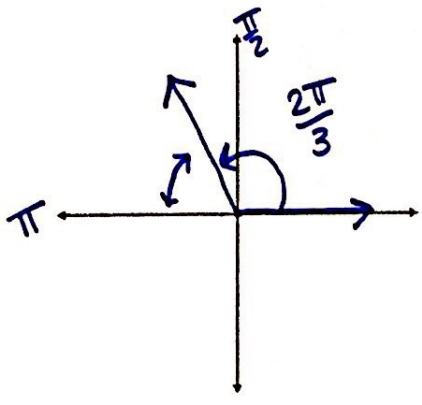
6. -310°



Ref.

$-310+360=50°$

7. $\frac{2\pi}{3}\cdot\frac{2}{2}=\frac{4\pi}{6}$



Ref: $\pi-\frac{2\pi}{3}=$

$\frac{\pi}{3}$