# **Precalculus**
# **Conversions between degrees and radians**

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## Degrees and radians

- Degrees is a unit for measuring angles, denoted by $^\circ$.
- The relationship between degrees and radians is:

$$\begin{aligned} \pi \text{ rad} &= 180^\circ \\ 1 \text{rad} &= \frac{180^\circ}{\pi} \approx 57.3^\circ \\ 1^\circ &= \frac{\pi}{180} \text{ rad} \approx 0.017 \text{ rad.} \end{aligned}$$

- In other words, a half-turn is measured by $\pi$rad or $180^\circ$.
- Degrees are useful because the most frequently encountered fractions of a half turn are measured by a whole number of degrees.
- If a measurement unit is not specified, it is implied to be radians. For example, in sin 5, the number 5 stands for 5 radians.

$$t^\circ = \frac{t}{180}\pi \text{ (radians)}.$$

## Example

Convert from degrees to radians.

| Deg. | $45^\circ$ | $36^\circ$ | $-20^\circ$ | $360^\circ$ | $-720^\circ$ | $-225^\circ$ | $2015^\circ$ |
|------|-----|-----|------|------|-------|-------|-------|
| Rad. | $\dfrac{\pi}{4}$ | $\dfrac{\pi}{5}$ | $-\dfrac{\pi}{9}$ | $2\pi$ | $-4\pi$ | $-\dfrac{5\pi}{4}$ | $\dfrac{403}{36}\pi$ |

$$x = \frac{x}{\pi}180^\circ.$$

## Example

Convert from radians to degrees.

| Rad. | $\dfrac{\pi}{3}$ | $\dfrac{\pi}{10}$ | $\dfrac{11\pi}{6}$ | $\dfrac{7\pi}{4}$ | $\dfrac{\pi}{7}$ | $\dfrac{13\pi}{6}$ | $-\dfrac{5\pi}{4}$ | 2 |
|------|-----|------|------|------|-----|------|------|---|
| Deg. | $60^\circ$ | $18^\circ$ | $330^\circ$ | $315^\circ$ | $\dfrac{180^\circ}{7} \approx 25.7^\circ$ | $390^\circ$ | $-225^\circ$ | $\dfrac{2}{\pi}180^\circ \approx 114.6^\circ$ |