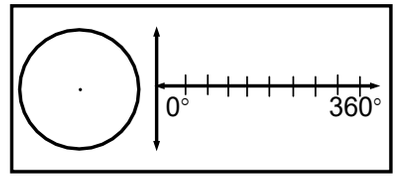
5.2 Trigonometric Base Functions

Spaghetti Math

Lay out your chart paper width-wise (landscape)
On the LEFT SIDE of the chart paper, paste your circle.
Draw an axis out from the centre of your circle to the far end of your chart paper.
On your x-axis, mark off every 15°, up to 360°



Tables 1, 2 and 3

1. Using a piece of spaghetti, determine the **vertical height** from the circle to the x-axis at 15°. Snap a piece of spaghetti to this length.

2. Glue the piece of spaghetti to the paper along the graph at 15°.

3. Determine the **vertical height** from the circle to the x-axis at **each** of the angles and glue the spaghetti at the appropriate place (up to 360°).

4. Using a marker, smoothly join the tops of each of the spaghetti pieces.

5. On another piece of chart paper and at the same time, complete a table of values with the following columns.

Tables 4,5 and 6

1. Using a piece of spaghetti, determine the **horizontal length** from the centre of the circle to the edge of the circle along the x-axis(0°). Snap a piece of spaghetti to this length.

2. Glue this piece onto the graph at 0°.

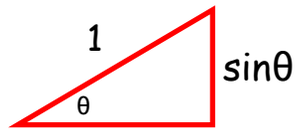
3. Drop the perpendicular from the point at 15° to the *x*-axis and then snap a piece of spaghetti to be the **length along the *x*-axis**. Glue the piece of spaghetti to the paper on the graph at 15 °.

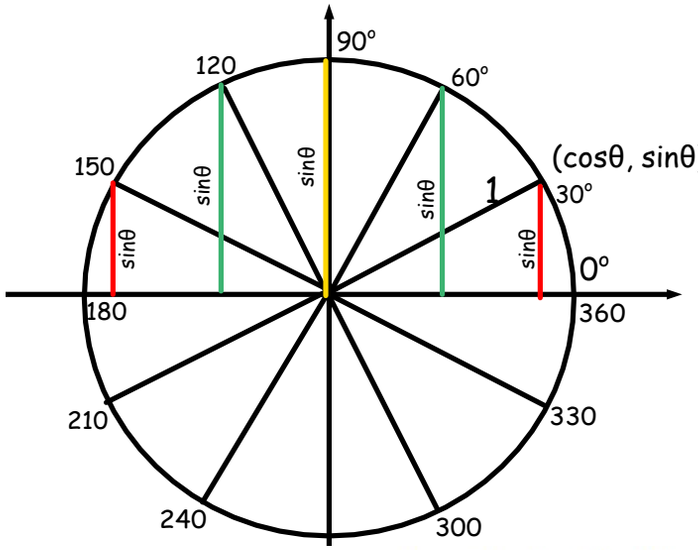
4. Determine the **horizontal lengths** from the perpendicular to the centre of the circle at each of the angles and glue the spaghetti at the appropriate place (up to 360°).

5. Using a marker, smoothly join the tops of each of the spaghetti pieces.

5.2 Trigonometric Base Functions

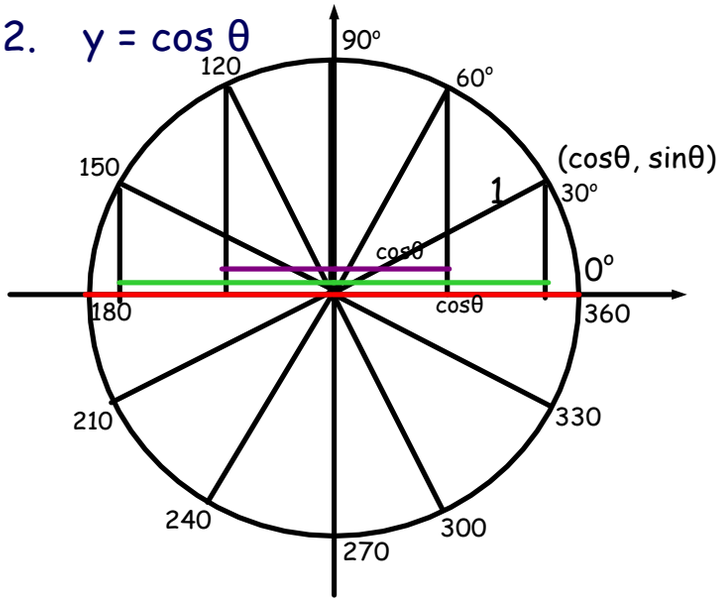
1. $y = \sin\theta$

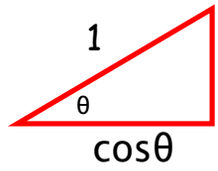




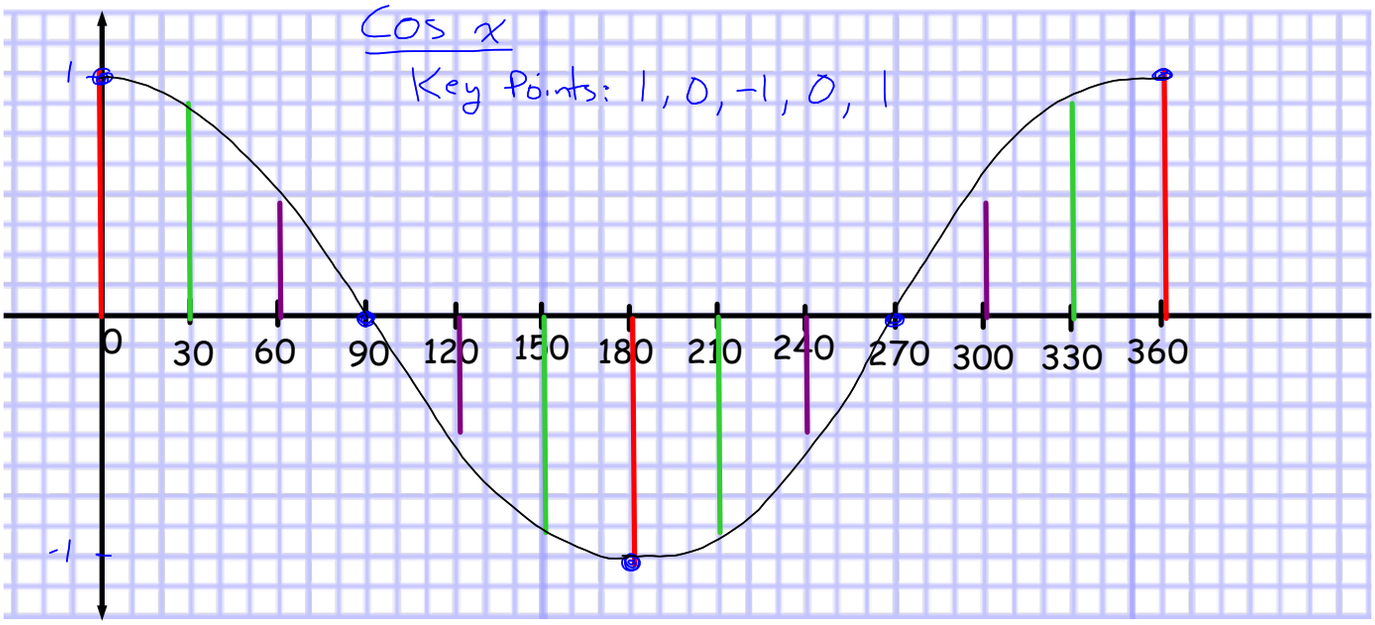
x degrees	0	30	45	60	90	120	135	150	180	210	225	240	270	300	315	330	360
sinθ (exact)	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	-1	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$	0
sinθ (approx)	0	0.5	0.7	0.9	1	0.9	0.7	0.5	0	-0.5	-0.7	-0.9	-1	-0.9	-0.7	0.5	0

2. $y = \cos\theta$





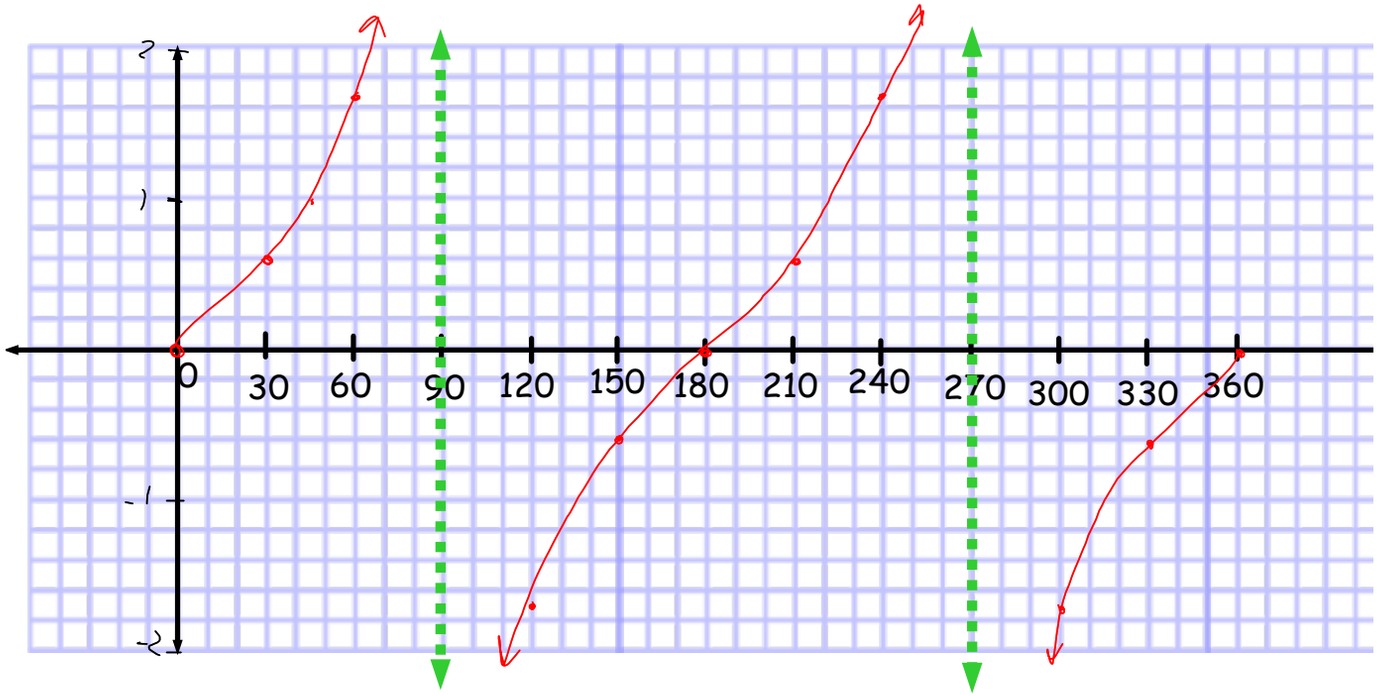
x degrees	0	30	45	60	90	120	135	150	180	210	225	240	270	300	315	330	360
cosθ (exact)	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{3}}{2}$	−1	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{2}}{2}$	$-\frac{1}{2}$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
cosθ (approx)	1	0.9	0.7	0.5	0	-0.5	-0.7	-0.9	−1	-0.9	-0.7	-0.5	0	0.5	0.7	0.9	1



3. y=tanθ

recall: $\tan\theta = \frac{\sin\theta}{\cos\theta}$

x degrees	0	30	45	60	90	120	135	150	180	210	225	240	270	300	315	330	360
tanx (exact)	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	UNDEF	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	UNDEF	$-\sqrt{3}$	-1	$-\frac{1}{\sqrt{3}}$	0
tanx (approx)	0	0.6	1	1.7		-1.7	-1	-0.6	0	0.6	1	1.7		-1.7	-1	-0.6	0



4. Properties of the base trigonometric functions.

Properties	y=sinx	y=cosx	y=tanx
domain	$D=\{x\in \mathbb{R}\}$	$D=\{x\in \mathbb{R}\}$	$D=\{x\in \mathbb{R} / x\neq \ldots -90^{\circ},90^{\circ},270^{\circ}\ldots\}$
range	$R=\{y\in\mathbb{R}/-1\leq y\leq 1\}$	$R=\{y\in\mathbb{R}/-1\leq y\leq 1\}$	$R=\{y\in\mathbb{R}\}$
max value	1	1	∞
min value	-1	-1	$-\infty$
period	360°	360°	180°
amplitute	1	1	∞
x-int	$\{\ldots 0^{\circ},180^{\circ},360^{\circ},\ldots\}$	$\{\ldots -90^{\circ},90^{\circ},270^{\circ},\ldots\}$	$\{\ldots 0^{\circ},180^{\circ},360^{\circ},\ldots\}$
y-int	0	1	0
asymptotes	none	none	$x=\{\ldots -90^{\circ},90^{\circ},270^{\circ},\ldots\}$
interval of increase $0^{\circ}\leq x\leq 360^{\circ}$	$\{x\in R / 0^{\circ}\leq x\leq 90^{\circ},270^{\circ}\leq x\leq 360^{\circ}\}$	$\{x\in R / 180^{\circ}\leq x\leq 360^{\circ}\}$	$\{x\in R / 0^{\circ}\leq x\leq 360^{\circ}, x\neq 90^{\circ},270^{\circ}\}$
interval of decrease $0^{\circ}\leq x\leq 360^{\circ}$	$\{x\in R / 90^{\circ}\leq x\leq 270^{\circ}\}$	$\{x\in R / 0^{\circ}\leq x\leq 180^{\circ}\}$	none

Homework

Part A

For each of the reciprocal functions, y=cscx, y=secx, y=cotx:

- Complete a table of values using special angles (30,45,60,90,etc) and then evaluate the exact and approx value of the function from $0^0 \leq x \leq 360^0$. (Use a similar template to our lesson today)

- Graph the functions for $-360^0 \leq x \leq 360^0$ on separate grids.
  (Be sure to label asymptote(s), if any, on the graph.)

- State the domain and range of each function.