Name Sru Deut

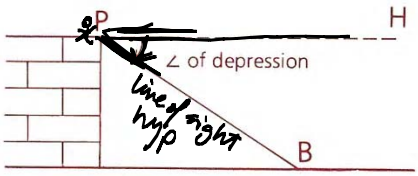
AMDG

Ms. Kresovic
Adv Geo – per 8
~~Mon~~ Tue 25 Mar 2014

9-10: Trigonometric Ratios

Objective: After studying this section, I can use trigonometric ratios to solve right triangles.

Prior Knowledge: SOH CAH TOA.
Special families of right triangles (30°, 60°, 90°) ⇔ (x, x√3, 2x) & (45°, 45°, 90°) ⇔ (x, x, x√2)

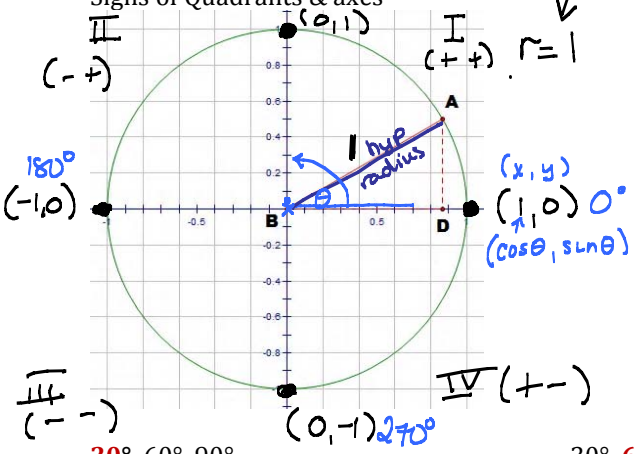


Note Do not forget that an angle of elevation or depression is an angle between a line of sight and the *horizontal*. Do not use the vertical.

θ = theta, Greek "T"

Q: How can I find the trigonometric value of any angle?!?
A: The Unit Circle (which you will study in depth next year).

Signs of Quadrants & axes



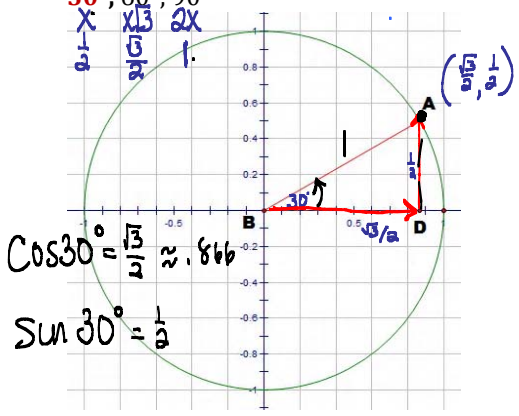
30	60	90
x	x√3	2x
1/2	√3/2	1

x's:
cos 0° = 1
cos 90° = 0
cos 180° = -1
cos 270° = 0

ys
sin 0 = 0
sin 90 = 1
sin 180 = 0
sin 270 = -1

If x√2 = 1
x = √2/2

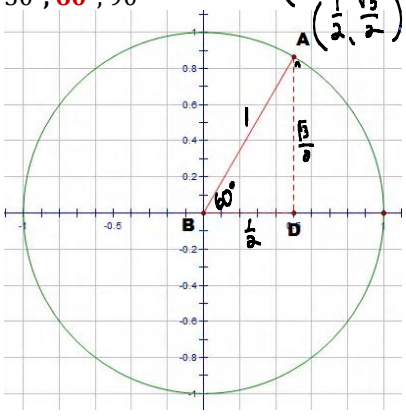
30°, 60°, 90°



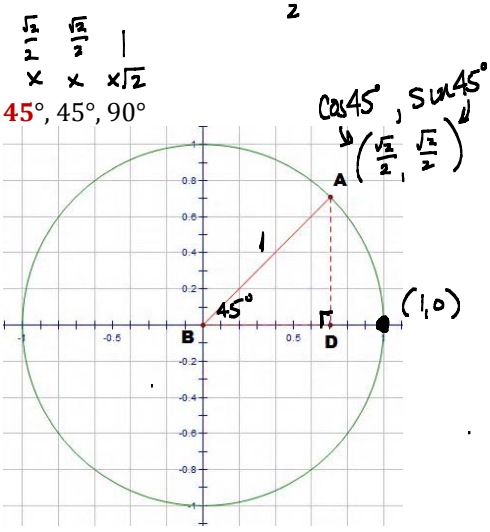
Cos 30° = √3/2 ≈ .866

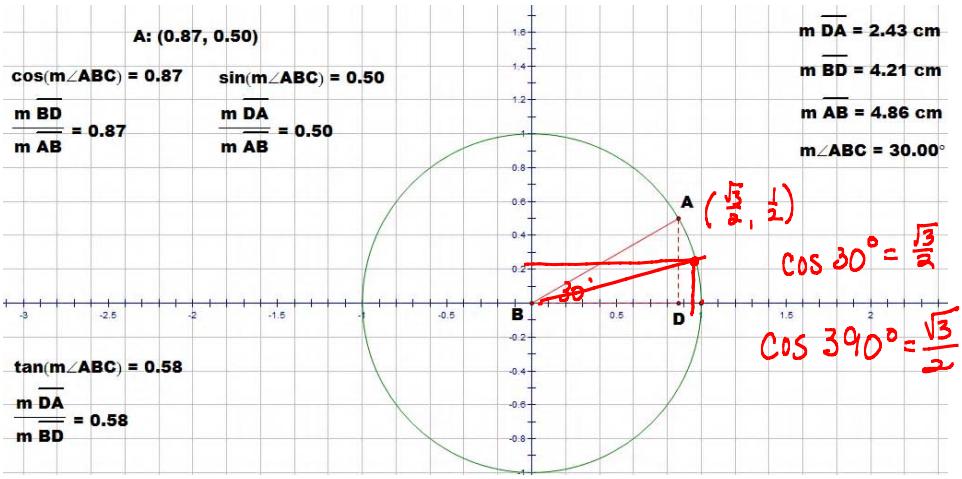
Sin 30° = 1/2

30°, **60**°, 90°



45°, 45°, 90°





$\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

$\cos 30° = \frac{\sqrt{3}}{2}$

$\cos 390° = \frac{\sqrt{3}}{2}$

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

Table of Trigonometric Ratios

∠A	sin ∠A	cos ∠A	tan ∠A	∠A	sin ∠A	cos ∠A	tan ∠A
1°	.0175	.9998	.0175	46°	.7193	.6947	1.0355
2°	.0349	.9994	.0349	47°	.7314	.6820	1.0724
3°	.0523	.9986	.0524	48°	.7431	.6691	1.1106
4°	.0698	.9976	.0699	49°	.7547	.6561	1.1504
5°	.0872	.9962	.0875	50°	.7660	.6428	1.1918
6°	.1045	.9945	.1051	51°	.7771	.6293	1.2349
7°	.1219	.9925	.1228	52°	.7880	.6157	1.2799
8°	.1392	.9903	.1405	53°	.7986	.6018	1.3270
9°	.1564	.9877	.1584	54°	.8090	.5878	1.3764
10°	.1736	.9848	.1763	55°	.8192	.5736	1.4281
11°	.1908	.9816	.1944	56°	.8290	.5592	1.4826
12°	.2079	.9781	.2126	57°	.8387	.5446	1.5399
13°	.2250	.9744	.2309	58°	.8480	.5299	1.6003
14°	.2419	.9703	.2493	59°	.8572	.5150	1.6643
15°	.2588	.9659	.2679	60°	.8660	.5000	1.7321
16°	.2756	.9613	.2867	61°	.8746	.4848	1.8040
17°	.2924	.9563	.3057	62°	.8829	.4695	1.8807
18°	.3090	.9511	.3249	63°	.8910	.4540	1.9626
19°	.3256	.9455	.3443	64°	.8988	.4384	2.0503
20°	.3420	.9397	.3640	65°	.9063	.4226	2.1445
21°	.3584	.9336	.3839	66°	.9135	.4067	2.2460
22°	.3746	.9272	.4040	67°	.9205	.3907	2.3559
23°	.3907	.9205	.4245	68°	.9272	.3746	2.4751
24°	.4067	.9135	.4452	69°	.9336	.3584	2.6051
25°	.4226	.9063	.4663	70°	.9397	.3420	2.7475
26°	.4384	.8988	.4877	71°	.9455	.3256	2.9042
27°	.4540	.8910	.5095	72°	.9511	.3090	3.0777
28°	.4695	.8829	.5317	73°	.9563	.2924	3.2709
29°	.4848	.8746	.5543	74°	.9613	.2756	3.4874
30°	.5000	.8660	.5774	75°	.9659	.2588	3.7321
31°	.5150	.8572	.6009	76°	.9703	.2419	4.0108
32°	.5299	.8480	.6249	77°	.9744	.2250	4.3315
33°	.5446	.8387	.6494	78°	.9781	.2079	4.7046
34°	.5592	.8290	.6745	79°	.9816	.1908	5.1446
35°	.5736	.8192	.7002	80°	.9848	.1736	5.6713
36°	.5878	.8090	.7265	81°	.9877	.1564	6.3138
37°	.6018	.7986	.7536	82°	.9903	.1392	7.1154
38°	.6157	.7880	.7813	83°	.9925	.1219	8.1443
39°	.6293	.7771	.8098	84°	.9945	.1045	9.5144
40°	.6428	.7660	.8391	85°	.9962	.0872	11.4301
41°	.6561	.7547	.8693	86°	.9976	.0698	14.3007
42°	.6691	.7431	.9004	87°	.9986	.0523	19.0811
43°	.6820	.7314	.9325	88°	.9994	.0349	28.6363
44°	.6947	.7193	.9657	89°	.9998	.0175	57.2900
45°	.7071	.7071	1.0000				

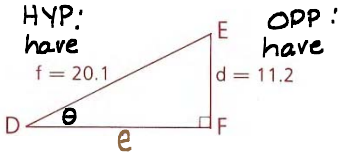
Ex 3

SOH CAH TOA

Problem 1 Given: Right $\triangle DEF$ as shown

Find: **a** $m\angle D$ to the nearest degree

b e to the nearest tenth



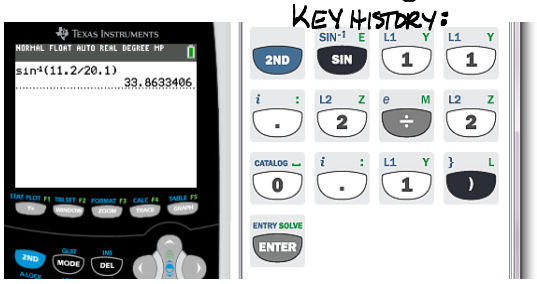
a $m\angle D$:

$$\sin\angle D = \frac{11.2}{20.1}$$

$$\angle D = \sin^{-1}\left(\frac{11.2}{20.1}\right)$$

↑ inverse of sin aka "angle-finder"

KEY HISTORY:



$\angle D \approx 34°$

b Pythagorean Theorem

$e^2 + d^2 = f^2$

$e = \sqrt{f^2 - d^2}$

$e = \sqrt{20.1^2 - 11.2^2}$

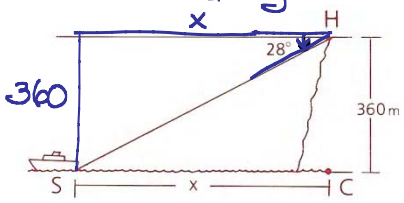
$e \approx 16.7$

SOH CAH TOA

Problem 2 *To an observer on a cliff 360 m above sea level, the angle of depression of a ship is 28°. What is the horizontal distance between the ship and the observer?*

need adj: x

have opp: 360



$\tan 28° = \frac{360}{x}$

$x(\tan 28) = 360$

$x = \frac{360}{\tan 28°} \approx 677\ m$

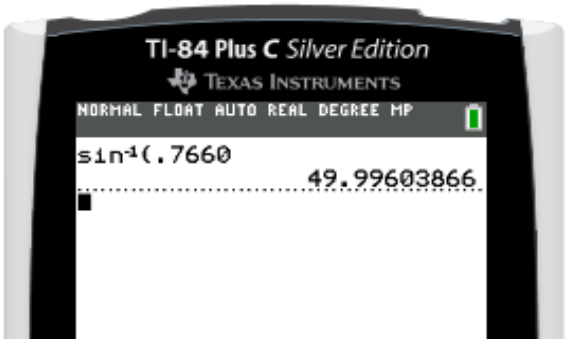
Problem 3 *Given the trig value, find the angle: If $\sin\theta = 0.7660$, find θ.*

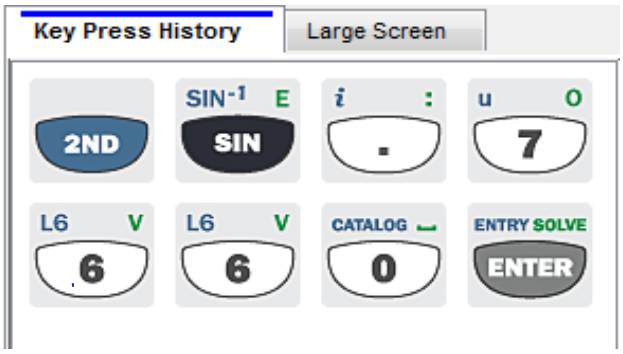
Method 1: Table

$\sin\theta = .7660$

$\theta = 50^\circ$ (see table)

Method 2: Calculator (& what happens)





Method 3 (unless it's a special, this method is the least accurate if it's a quick sketch):
I don't have a table or calculator, but I can use the unit circle.

Treat: Trig Unit circle Trick
http://www.youtube.com/watch?v=1-hrT1Ys390

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9-10: Trigonometric Ratios: 1-12, 14, & 15

1 Find each of the following in the Table of Trigonometric Ratios.

a sin 21° **b** tan 52° **c** cos 5° **d** tan 45° **e** sin 60°

$\approx .3584$

2 Using the table, find m∠A in each case.

a sin ∠A = 0.4067 **b** tan ∠A = 3.4874 **c** cos ∠A = .7071

$\angle A \approx 24°$

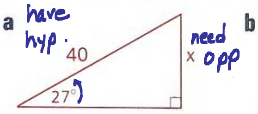
see 9.9 #11

3 Without using the table, find m∠A in each case.

a tan ∠A = 1 **b** $\sin \angle A = \frac{1}{2}$ **c** $\sin \angle A = \frac{\sqrt{3}}{2}$

4 In each case, find x to the nearest integer.

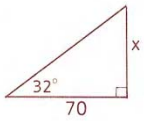
a have hyp. 40, need x opp, 27°



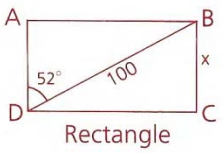
$\sin 27° = \frac{x}{40}$

$40(\sin 27) = x$

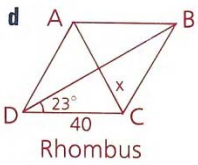
b



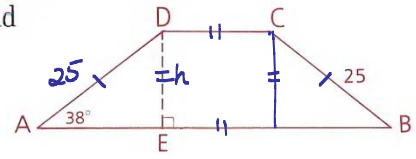
c



d



5 Find the height of isosceles trapezoid ABCD.



$\sin 38 = \frac{h}{25}$

$h = 25(\sin 38)$

5b: Find the area of the trapezoid (above). $A_{TRAP} = (\text{AVERAGE BASES} \cdot \text{HEIGHT})$

6 Solve each equation for x to the nearest integer.

a $\sin 25° = \frac{x}{40}$

$x = 40(\sin 25)$

$x =$

b $\cos 73° = \frac{35}{x}$

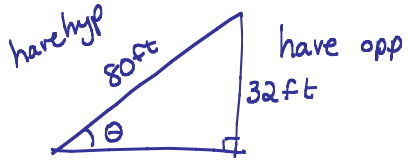
$x(\cos 73) = 35$

$x = \frac{35}{\cos 73}$

c $\sin x° = \frac{29}{30}$

$x = \sin^{-1}\left(\frac{29}{30}\right)$

7 A department-store escalator is 80 ft long. If it rises 32 ft vertically, find the angle it makes with the floor.

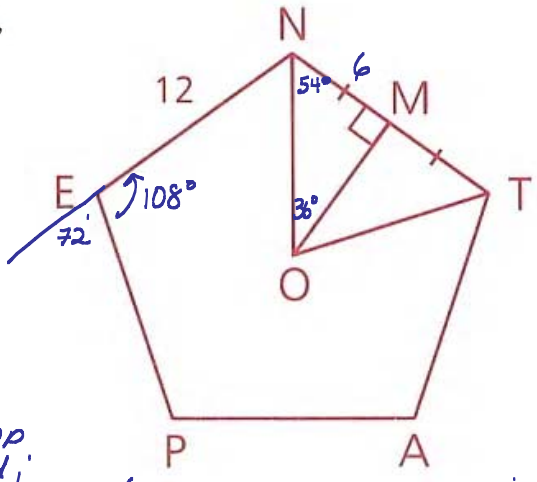


$\sin\theta = \frac{32}{80}$

$\theta = \sin^{-1}\left(\frac{32}{80}\right)$

$\frac{360}{5} = 72°$

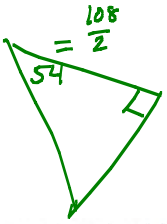
8 Given the regular pentagon shown, with center at O and EN = 12 cm,



a Find m∠E

supp of ext ∠ $180 - \left(\frac{360}{5}\right) = 108°$

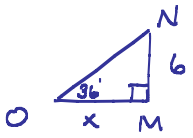
b Find m∠NOM



$90 - 54 = \angle NOM$

$36° = \angle NOM$

c Find OM to the nearest hundredth



have opp
need adj
$\therefore \tan 36° = \frac{6}{x}$

$x(\tan 36) = 6$

$x = 6/\tan 36$

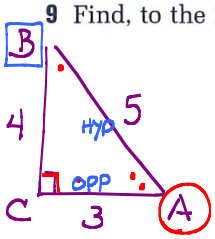
$\approx 8.26\text{cm}$

SOH
CAH
TOA

d Find the area of △NOT to the nearest hundredth

e Explain how you could find the area of the pentagon

9 Find, to the nearest degree, the angles of a (3, 4, 5) triangle.



$\angle C = 90°$

$\angle B =$

$\angle A =$

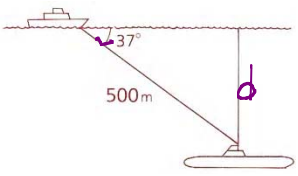
$\sin \angle B = \frac{3}{5} \rightarrow \angle B = \sin^{-1}(3/5)$

$\angle B \approx 37°$

$\angle A$ is comp $\angle B$ so $90 - 37 \approx 53°$

$\cos \angle B = \frac{4}{5} \rightarrow \angle B = \cos^{-1}\frac{4}{5} \rightarrow \angle B \approx 37°$

10 A sonar operator on a cruiser detects a submarine at a distance of 500 m and an angle of depression of 37°. How deep is the sub?



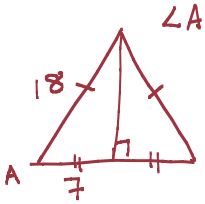
have hyp, need opp

$\sin 37° = \frac{d}{500}$

$d = 500(\sin 37°) \approx 301\text{ m}$

11 The legs of an isosceles triangle are each 18. The base is 14.

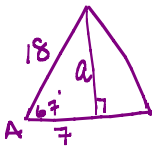
a Find the base angles to the nearest degree.



$\angle A$: HAVE HYP & ADJ, USE $\cos\angle A = \frac{7}{18}$

$\angle A = \cos^{-1}(7/18) \approx 67°$

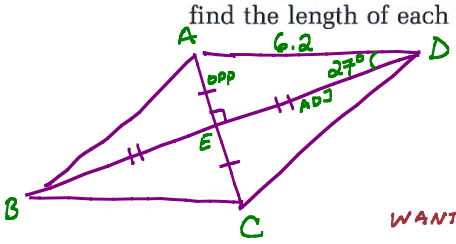
b Find the exact length of the altitude to the base.



$a^2 + 7^2 = 18^2$

$a = \sqrt{324-49} = \sqrt{275} = \sqrt{25}\cdot\sqrt{11} = 5\sqrt{11}$

12 One diagonal of a rhombus makes an angle of 27° with a side of the rhombus. If each side of the rhombus has a length of 6.2 in., find the length of each diagonal to the nearest tenth of an inch.



SOH CAH TOA

WANT OPP, HAVE HYP: $\sin 27° = \frac{AE}{6.2}$

$6.2(\sin 27°) = AE$

$2.81 = AE$

$\therefore AC \approx 5.6$ in

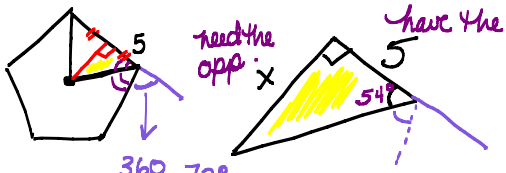
WANT ADJ, HAVE HYP → $\cos 27° = \frac{DE}{6.2}$

$6.2(\cos 27°) = DE$

$5.52 \approx ED \therefore BD \approx 11.0$ in

14 Find the length of the apothem of a regular pentagon that has a perimeter of 50 cm.

SOH CAH TOA



Side = 10 cm

$\frac{360}{5} = 72°$

Supp is $180 - 72 = 108°$

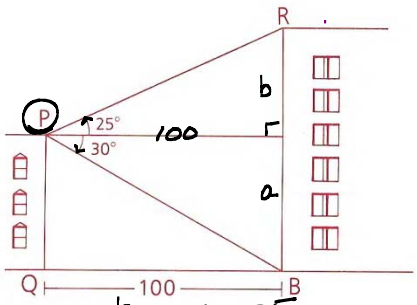
$\div 2 = 54$

$\tan 54° = \frac{x}{5}$

$5\tan 54° = x$

$6.88 \text{ cm} = x$

15 Two buildings are 100 dm apart across a street. A sunbather at point P finds the angle of elevation of the roof of the taller building to be 25° and the angle of depression of its base to be 30°. Find the height of the taller building to the nearest decimeter.



height tall blg = $a+b$

$\tan 30 = \frac{a}{100}$

$100(\tan 30°) = a = 57.74$ dm

$\frac{b}{100} = \tan 25$

$b = 100(\tan 25)$

$b = 46.63$ dm

$a+b = 57.7 + 46.63 = 104.33$

≈ 104 dm