

TEACHING CHURCH SCHOOL SCIENCE

Study Pack 03

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Teaching Church School Science

Study Pack 03 – Lecture 03

Vectors and Trigonometry

- 1) “Scalar Quantities” are numbers that just have _____.
- 2) In Physics, _____ is also important.
- 3) When you include both speed and direction, it is called a _____.
- 4) _____ is a vector quantity. It has magnitude and direction.
- 5) A _____ is a series of graduated marks. Like on a ruler or a graduated cylinder (or a speedometer) that you can use to _____ something.
- 6) 20 km = a _____.
- 7) 20 km west = a _____.
- 8) With _____, math is math. $3\text{km} + 2\text{km}$ always equals 5km.
- 9) With _____, there is more to consider:
 - a) $3\text{km East} + 2\text{km East} = 5\text{km East}$
 - b) $3\text{km East} + 2\text{km West} = 1\text{km East}$
 - c) $3\text{km West} + 2\text{km East} = 1\text{km West}$
 - d) $3\text{km North} + 2\text{km West} = 3.6\text{km Northwest}$
- 10) These answers in combining vectors are called the _____.
- 11) We combine vectors to find _____ (the answer when combining distances and directions) and the _____ (the answer when combining velocities).
- 12) _____ is a vector that combines speed and direction.

13) It is very convenient to break things down into _____
_____ when analyzing the physical world. This is why physics is just full
of trigonometry. Trigonometry is basically "_____".
_____."

14) _____: The square of the hypotenuse of a right
triangle is equal to the sum of the squares of the other 2 sides.

15) This gives you _____ but doesn't help with angle measures which are
important for specific direction.

16) The hypotenuse is the side _____ the right angle.

17) If you knew Side A was 6 cm and Side B was 8 cm. what is the hypotenuse?

a) $C^2 = A^2 + B^2$

b) $C^2 = 6^2 + 8^2$ [or $C^2 = (6 \times 6) + (8 \times 8)$]

c) $C^2 = 36 + 64$

d) $C^2 = 100$.

e) The square root of 100 is 10.

18) If you know that the hypotenuse is 20 m and A is 10 m. What is Side B? You invert the
formula.

$$B^2 = C^2 - A^2 = 20^2 - 10^2 = 400 - 100 = 300$$

a) The square root of 300 is about 17.3 m

19) The 3 functions that will come in handy are _____,
_____, and _____.

20) When we deal with right triangles, how many angles do we have? _____

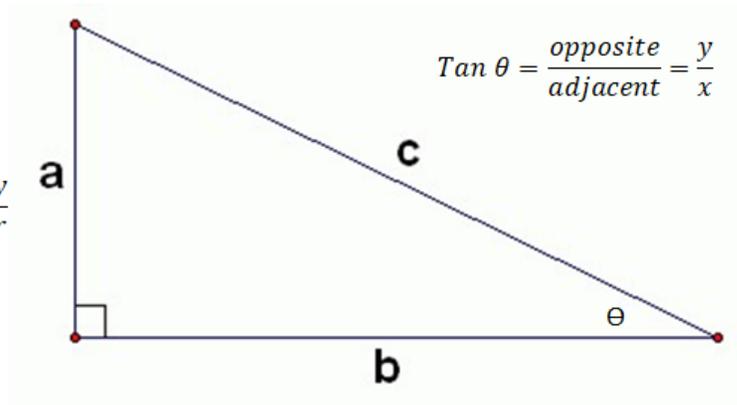
a) What is the measure of the right angle that must be present? _____

b) We call the angle we are dealing with (the angle in question) θ (_____)

Table 2: TRIGONOMETRIC FUNCTIONS

Angle	Sine	Cosine	Tangent	Angle	Sine	Cosine	Tangent
0	0.000	1.000	0.000				
1	0.017	1.000	0.017	46	0.719	0.695	1.04
2	0.035	0.999	0.035	47	0.731	0.682	1.07
3	0.052	0.999	0.052	48	0.743	0.669	1.11
4	0.070	0.998	0.070	49	0.755	0.656	1.15
5	0.087	0.996	0.087	50	0.766	0.643	1.19
6	0.105	0.995	0.105	51	0.777	0.629	1.23
7	0.122	0.993	0.123	52	0.788	0.616	1.28
8	0.139	0.990	0.141	53	0.799	0.602	1.33
9	0.156	0.988	0.158	54	0.809	0.588	1.38
10	0.174	0.985	0.176	55	0.819	0.574	1.43
11	0.191	0.982	0.194	56	0.829	0.559	1.48
12	0.208	0.978	0.213	57	0.839	0.545	1.54
13	0.225	0.974	0.231	58	0.848	0.530	1.60
14	0.242	0.970	0.249	59	0.857	0.515	1.66
15	0.259	0.966	0.268	60	0.866	0.500	1.73
16	0.276	0.961	0.287	61	0.875	0.485	1.80
17	0.292	0.956	0.306	62	0.883	0.469	1.88
18	0.309	0.951	0.325	63	0.891	0.454	1.96
19	0.326	0.946	0.344	64	0.899	0.438	2.05
20	0.342	0.940	0.364	65	0.906	0.423	2.14
21	0.358	0.934	0.384	66	0.914	0.407	2.25
22	0.375	0.927	0.404	67	0.921	0.391	2.36
23	0.391	0.921	0.424	68	0.927	0.375	2.48
24	0.407	0.914	0.445	69	0.934	0.358	2.61
25	0.423	0.906	0.466	70	0.940	0.342	2.75
26	0.438	0.899	0.488	71	0.946	0.326	2.90
27	0.454	0.891	0.510	72	0.951	0.309	3.08
28	0.469	0.883	0.532	73	0.956	0.292	3.27
29	0.485	0.875	0.554	74	0.961	0.276	3.49
30	0.500	0.866	0.577	75	0.966	0.259	3.73
31	0.515	0.857	0.601	76	0.970	0.242	4.01
32	0.530	0.848	0.625	77	0.974	0.225	4.33
33	0.545	0.839	0.649	78	0.978	0.208	4.70
34	0.559	0.829	0.675	79	0.982	0.191	5.14
35	0.574	0.819	0.700	80	0.985	0.174	5.67
36	0.588	0.809	0.727	81	0.988	0.156	6.31
37	0.602	0.799	0.754	82	0.990	0.139	7.12
38	0.616	0.788	0.781	83	0.993	0.122	8.14
39	0.629	0.777	0.810	84	0.995	0.105	9.51
40	0.643	0.766	0.839	85	0.996	0.087	11.43
41	0.656	0.755	0.869	86	0.998	0.070	14.30
42	0.669	0.743	0.900	87	0.999	0.052	19.08
43	0.682	0.731	0.933	88	0.999	0.035	28.64
44	0.695	0.719	0.966	89	1.000	0.017	57.29
45	0.707	0.707	1.000	90	1.000	0.000	undefined

$$\sin \theta = \frac{\text{side opposite } \theta}{\text{hypotenuse}} = \frac{y}{r}$$



$$\cos \theta = \frac{\text{side adjacent } \theta}{\text{hypotenuse}} = \frac{x}{r}$$

21) The equations look like this:

a) $\sin \theta = \frac{\text{side opposite } \theta}{\text{hypotenuse}} = \frac{y}{r}$

b) $\cos \theta = \frac{\text{side adjacent } \theta}{\text{hypotenuse}} = \frac{x}{r}$

c) $\tan \theta = \frac{\text{opposite}}{\text{adjacent}} = \frac{y}{x}$

(The side next to the θ is Adjacent. The side which does not touch θ is the Opposite side. Note that which side is Adjacent and which side is Opposite is always determined by its position relative to θ .)

22) θ (Theta) is just a number that represents the _____ of those sides.

23) Sine θ or Cosine θ is going to be a decimal number _____ 0 and 1.

24) Tangent θ will still probably be a weird decimal, but it can be _____ than 1.

25) To find the angle measure you would need a _____ or (more likely) a calculator or a calculator app on your smart phone.

26) To solve for an angle: Once you find the solved function, you go to your Trig Table. Find the number _____ to your _____ listed in the correct column; then you _____ it across to the angle.

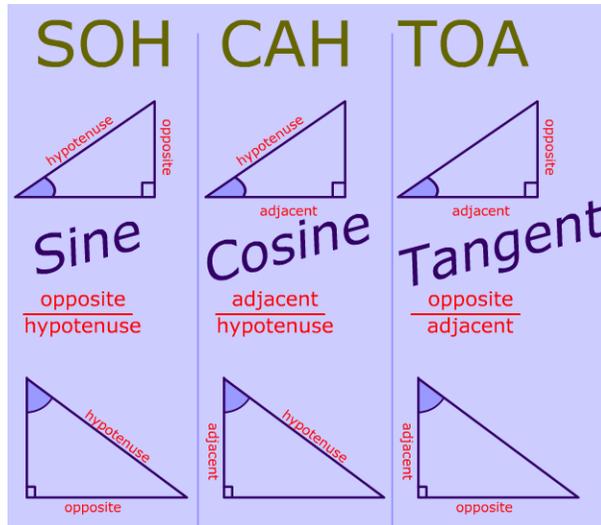
27) This is finding the _____, _____, or _____ of the function.

28) To remember which equation is which, remember: “SOHCAHTOA”.

a) SOH - Sine = _____ / _____

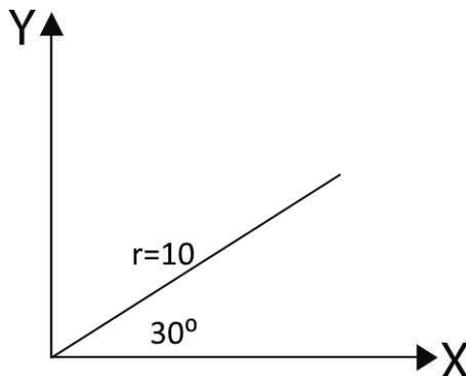
b) CAH - Cosine = _____ / _____

c) TOA - Tangent = _____ / _____



29) The angle in question (θ) can be anything that isn't the _____. Notice how _____ and _____ move around depending on where θ is.

30) It is convenient to picture these things in a _____. Particularly when we are dealing with _____ (North, South, East, West) or _____ and _____ components.



31) Here we have a vector of magnitude 10 that extends at an angle of 30° into the first quadrant of an X-Y coordinate system.

a) We know the _____ and we want to find the X component and the Y component.

b) 'Y' is the opposite side, so we'll start with the formula: _____ = _____ / _____.

i) $\text{Sine } \theta (30^\circ) = \text{Opposite (Y)} / 10$

c) We need to _____ the formula so that we are solving for '_____' or the '_____' (Not to be confused with the 'Y' axis on the graph). This would be $\text{Opposite} = \text{hyp} * \text{Sine } \theta$.

i) Remember, the hypotenuse (10) and 'r' are the same. 'θ' is the ratio or result we already have: 30° .

d) _____ (Opposite) = $r * \text{Sine } 30^\circ$ (Go to the Trig Table and find the Sine for a 30° angle.)

e) _____ = $10 * .500$ (Multiply 10 by .500) _____ = 5.0

32) 'x' is the adjacent side (not to be confused with the 'X' axis on the graph), so we want _____ = _____ / _____.

a) Rearrange.

b) _____ = $\text{hyp} * \text{Cosine } \theta$

c) _____ = $r * \text{Cosine } 30^\circ$ (Go to the Trig Table and find Cosine for a 30° angle.)

d) _____ = $10 * .866$ (Multiply 10 by .866)

e) _____ = 8.7

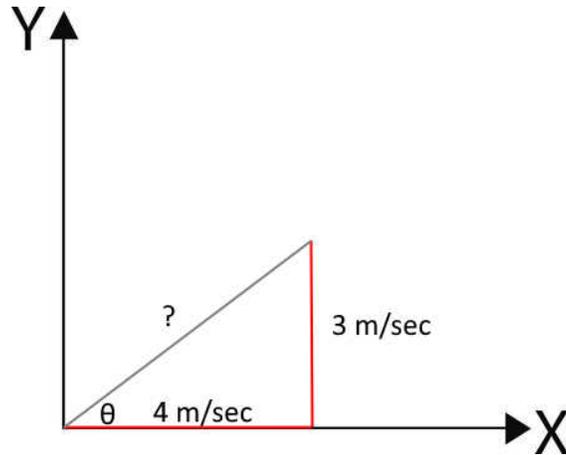
33) Notice the numbers we used for Sine and Cosine were rounded to the _____.

a) This is to match the trig table for ease of _____ and for writing down. If you find those values with a calculator, it will be a long number. You can use those values and they will work.

b) Also, notice that our answer for 'x' would have been _____ (or more digits if using a calculator). Why is our answer 8.7? _____

_____. Our original measurement (10) has _____ significant figures so that is what our answer will have.

34) If you have the _____ vectors, you can combine them in the same way.



35) Remember, vectors have two components, _____ and _____, so our answer will need to include both of these.

36) We have an X Component (Adjacent) of 4m/sec and a Y Component (Opposite) of 3m/sec.

a) What function will we use?

b) Tangent = _____ / _____

c) _____ $\theta = 3/4 = .750$ m/s

37) We need the angle so we need to find the _____ of .750

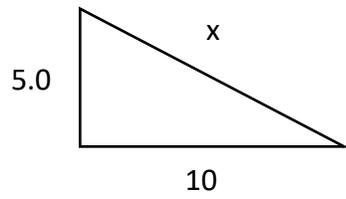
a) The trig table would give you an answer of 37° Since _____ is the closest value it has to _____.

38) A calculator will give you a _____ number beginning with 36.8698976. for our purposes we will round it to 36.9°

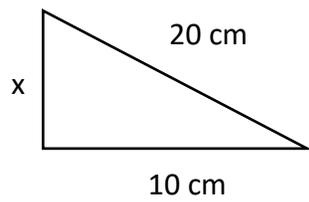
39) These types of equations can be applied to all kinds of _____.

Practice Problems:

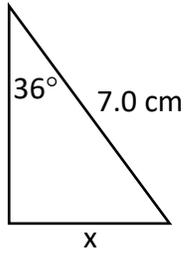
1. What is the value of 'x' in the right triangle below?



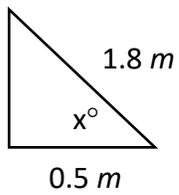
2. What is the value of 'x' in the right triangle below?



3. What is the value of 'x' in the right triangle below?



4. What is the value of arccosine 'x' in the right triangle below?



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