

## Ch-1

There are no problems in this chapter

## Ch-2

1- Find the difference between  $\sin 10^\circ$  and  $\tan 10^\circ$ .

Solution:

$$\sin 10^\circ = 0.1736482$$

$$\tan 10^\circ = 0.1763270$$

$$\text{Diff} = 0.002679$$

The reason for this problem is to point out to the important fact that for small angles the sine and tangent of the angle are very similar with small difference.

2- Find the difference between  $\cos 5^\circ$  and  $\sin 85^\circ$ .

Solution:

$$\cos 5^\circ = 0.996195$$

$$\sin 85^\circ = 0.996195$$

The reason for this problem is to point out that for any two angles whose sum is  $90^\circ$  the of one is equal to the cosine of the other.

3- Calculate  $\sin 25^\circ$ ,  $\sin 65^\circ$  and add them together. Compare the result with  $\sin 90^\circ$ . Which one is larger?

Solution:

$$\sin 25^\circ = 0.422618$$

$$\sin 65^\circ = 0.906308$$

$$0.422618 + 0.906308 = 1.328926$$

The reason for this problem is to show that there is no correspondence between the trigonometric functions of angles and the angle values. The sum of  $25^\circ$  and  $65^\circ$  is  $90^\circ$ . But  $\sin 90^\circ = 1$ . Therefore, in no way one may add two function values and take it for the corresponding function for the sum of the angles.

4- Make a table of the following values:

$\sin 0^\circ$ ,  $\sin 10^\circ$ ,  $\sin 20^\circ$ ,  $\sin 30^\circ$ ,  $\sin 40^\circ$ ,  $\sin 50^\circ$ ,  $\sin 60^\circ$ ,  $\sin 70^\circ$ ,  $\sin 80^\circ$ ,  $\sin 90^\circ$ . Use 3 decimal places.

Solution:

Angle	$10^\circ$	$20^\circ$	$30^\circ$	$40^\circ$	$50^\circ$	$60^\circ$	$70^\circ$	$80^\circ$	$90^\circ$
Sine value	0.174	0.342	0.500	0.643	0.766	0.866	0.940	0.985	1.000

5- Find the angles between  $0$  and  $90^\circ$ , whose cos values are as follows:

0.25, 0.35, 0.45, 0.55, 0.65, 0.75, 0.85, 0.95.

Solution:

$$\cos^{-1} 0.25 = 75.52^\circ, \cos^{-1} 0.35 = 69.51^\circ, \cos^{-1} 0.45 = 63.26^\circ, \cos^{-1} 0.55 = 56.63^\circ,$$

$$\cos^{-1} 0.65 = 49.46^\circ, \cos^{-1} 0.75 = 41.41^\circ, \cos^{-1} 0.85 = 31.79^\circ, \cos^{-1} 0.95 = 18.19^\circ,$$

6- What is the angle that if its tangent is multiplied by 3 the result is 10?

Solution:

$$\text{So, tangent of the angle} = 10/3 = 3.333333$$

$$\tan^{-1} 3.333333 = 73.3^\circ$$

7- What is the angle that if its tangent is multiplied by 3 the result is 100?

Solution:

$$\tan^{-1} 33.333333 = 88.28^\circ$$

8- What is the angle that if its sin is multiplied by 3 the result is 2?

Solution:

$$\text{Angle} = \sin^{-1} (2/3) = 41.81^\circ$$

9- What is the angle that if its sin is multiplied by 2 the result is 3?

Solution:

There is no such angle. The sine values are always between -1 and +1.

10- If A, B, C and D are 4 variables and are related to each other by  $A.B.C = D$ , find each of the variables A, B and C in terms of the others.

Solution:

$$A = \frac{D}{BC}, \quad B = \frac{D}{AC}, \quad C = \frac{D}{AB}$$

11- If A, B, C and D are 4 variables and are related to each other by  $A + B - C = D$ , find each of the variables A, B and C in terms of the others.

Solution:

$$A = D - (B - C) = D - B + C, \quad B = D - (A - C) = D - A + C, \quad C = (A + B) - D = A + B - D$$

12- If A, B, C and D are 4 variables and  $\frac{A}{B} = \frac{C}{D}$ , find each of the variables A, B and C in terms of the others.

Solution:

Note that the equation given is equivalent to  $AD = BC$ .

$$A = \frac{BC}{D} \quad , \quad B = \frac{AD}{C} \quad , \quad C = \frac{AD}{B}$$

### Ch-3

1. From table 3.2 find all elements with 4 valence electrons.

Solution:

Carbon, Silicon, Germanium, Tin, Lead

2. From table 3.2 find the lightest and the heaviest elements.

Solution:

The lightest element is Hydrogen with the atomic number 1 and the heaviest is Ununseptium with atomic number 117.

3. From table 3.2 determine if selenium is a metal.

Solution:

Selenium has 6 valence electrons. It is not a metal.

4. Find from table 3.2 all the elements that have 8 valence electrons. What is the similarity between these elements?

Solution:

Neon, Argon, Krypton, Xenon, Radon

All of these are gas. They are inert (inactive) gases that do not have chemical reaction with any other element.

5. From table 3.2 find the electron structure of iron and copper. By using internet find the properties of these two metals.