6.03.2016 – N1

Show your work for each problem using numbers, sketches, or words.

Name:_____

1) Evaluate the triple scalar product, $\left(\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)\right)$ and triple vector product $\left(\vec{a}\times\left(\vec{b}\times\vec{c}\right)\right)$ in the case when:

$$\vec{a}=i-j+k,\ \vec{b}=i+j-k,\ \vec{c}=-i+j+k.$$

Hint: The base vectors of a rectangular x-y-z coordinate system are given by the unit vectors $\vec{i},\vec{j},\vec{k}$.

2) True or false.

$$\left(3a^2+5ab-5b^2\right)^3+\left(4a^2-4ab+6b^2\right)^3=\left(-5a^2+5ab+3b^2\right)^3+\left(6a^2-4ab+4b^2\right)^3$$

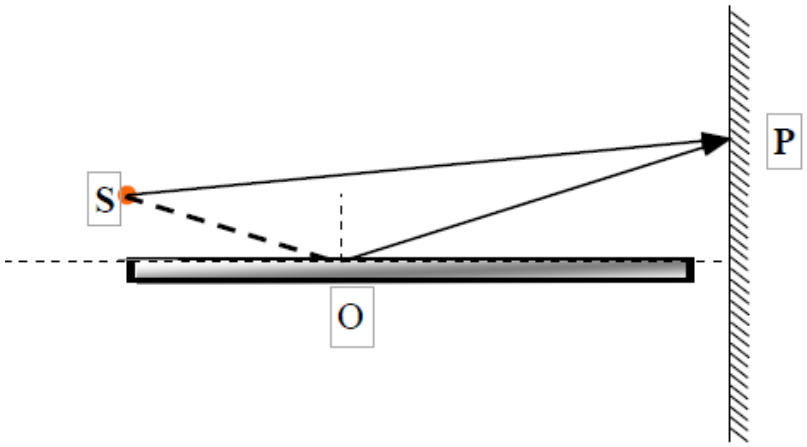
3) From site we can find:

Country	GDP per capita (US$)	CO_2 emissions per capita (metric tons)
Australia	39504	17.43
Canada	35811	15.37
China	3121	5.92
France	34538	5.04
Germany	37270	9.14
Japan	36157	9.28
Korea	21216	11.81
Mexico	8760	3.96
Russia	6674	11.65
UK	38040	7.06
USA	42385	16.94

Based on this information, is there a correlation between GDP per capita and CO_2 emissions per capita?

Hint: GDP – gross domestic product.

4) On the figure below is represented Lloyd's mirror. An interference pattern is produced at point P on the screen as a result of combination of the direct ray and reflected ray.

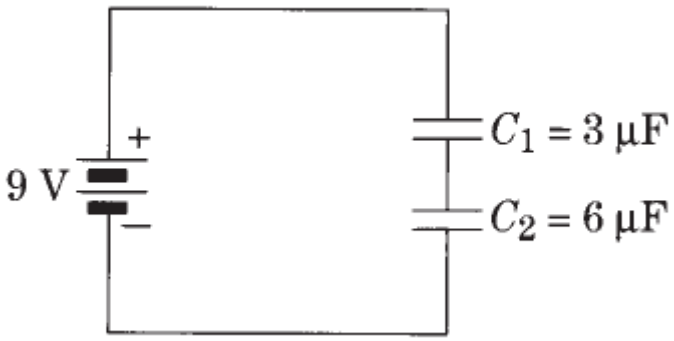


a) Find an expression for the separation of bright fringes on the screen. The light source S has wavelength λ and is located at the height d of the mirror plan. The screen is located at the distance D from source, perpendicularly to the mirror plan.

b) Propose a method for a fiber diameter measurements using Lloyd's mirror.

5) Light of wavelength 600 nm is incident on a metal surface. Electrons are ejected from the metal surface with a maximum kinetic energy of $3.1 \cdot 10^{-19}$ J. Calculate the work function of the metal surface.

6) Two capacitors initially uncharged are connected in series to a battery, as shown below. What is the charge on the top plate of C_1?



7) A cinema screen is a white painted surface designed to reflect light back into your eye. The more light that is reflected back the brighter the image will be. Why then can a mirror not be used instead?