Physics 10164 - Spring 2020 Exam 3

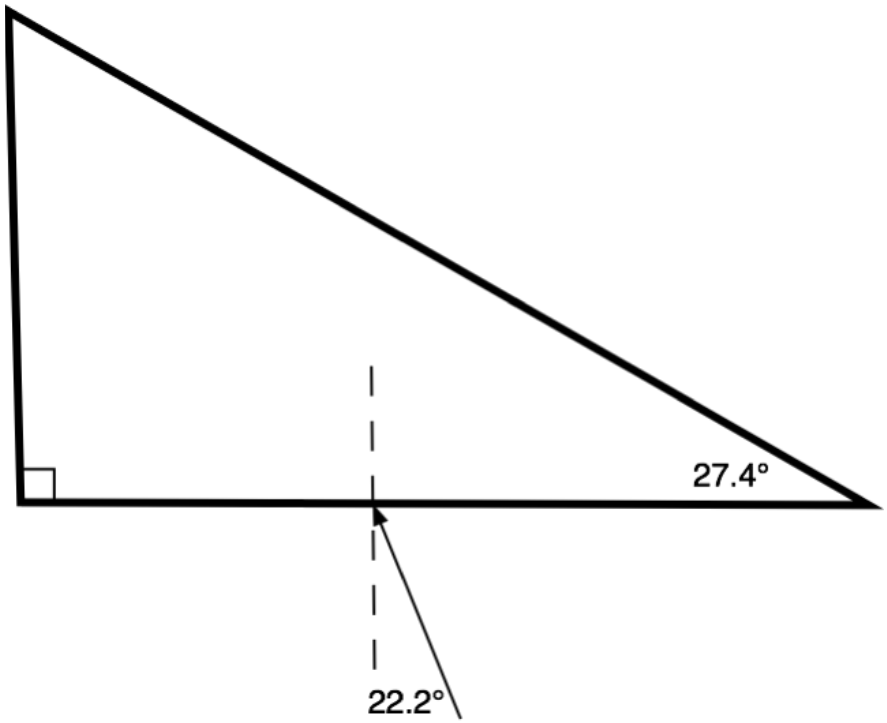
1. (25 pts) A radio station broadcast tower is operating at a frequency of 96.7 MHz with a power of 50,000 Watts. Its signal spreads out over a hemispherical area ($2\pi r^2$) to the surrounding region. A driver 12.0 km away from the broadcast tower has her car radio tuned in to the station. Answer each part below with 3 SF.

a) What is the wavelength of this broadcast?
b) What is the rms value of the magnetic field at the driver's location?
c) If the cross-sectional area of the driver's body is 1.50 m^2, how much energy does this broadcast carry through the body over the course of an hour?
d) If the volume of the driver's body is 88 Liters, how much energy from this broadcast is in the human body at any given time?

2) (25 pts) An object that is 28.0 cm in front of a mirror produces an upright image that is 35.0% as tall as the object.

a) What must the object distance be in order to result in an upright image 75.0% as tall as the object?
b) Is it possible for this mirror to produce an inverted image, assuming the object is real? If yes, provide an example (real) object distance that would result in an inverted image. If no, justify your answer.

3) (25 pts) The prism below has an index of refraction of 1.38 and is surrounded by air on all sides. Light is incident on the bottom face of the prism as shown. Through what face of the prism does the light exit, and what is the final angle of refraction?



4) (25 pts) A person has a near point of 82 cm and a far point of infinity. We want to prescribe eyeglasses for this person to correct the near point to its normal value of 25 cm. The eyeglasses will sit 2.0 cm in front of the eye.

a) What must be the focal length of these lenses?
b) What will be the new far point for this person while wearing the glasses? Keep in mind that you must account for the extra 2.0 cm between the lenses and the eye. I am asking what is the far point for the eye, not the lenses.