1) Taylor and Young Experiment: Consider a bistatic configuration where the transmitter and receiver are separated by a distance of 5 km. The radar is operating in the CW interference mode at a wavelength of 5 m. A ship reflects the radar waves as with the 1922 radar of Taylor and Young of NRL. Suppose the ship travels along a perpendicular bisector of the line connecting the transmitter and receiver at a constant velocity of 5 m/s. What will the envelope of the received waveform look like? What will be the period of the interference envelope as a function of ship distance from the line between radar transmitter and receiver? You may take the radar transmitter and receiver and the ship to be in the same plane. Doppler effects can be ignored for the purposes of this problem (think about whether this really matters). Assume that the reflected signal 3) arrives at the receiver with half the magnitude of the direct signal.

2) Radar Equation Spreadsheet
   a) Using a spread sheet of the form given in Handout no. 3, page 11, calculate the signal to noise ratio for the following system:

Transmit power:	2500 W
Cable losses:	1 dB
Antenna efficiency:	50%
Antenna size:	1 × 0.5 m
Noise temperature:	900 K
System bandwidth:	1 MHz
Wavelength:	24 cm
Distance:	15 Km
Object size:	10 × 5 m
Object σ^0:	− 15 dB

   b) Keeping the other system parameters the same, reevaluate the SNR for a wavelength of 3 cm. Why the difference?

3) Radar Equation for Imaging Radar: Design a radar (that is, generate a dB table spreadsheet) that can map a 5000 m wide swath from an aircraft flying at an 8000 m altitude. Set the incidence angle at the center of the swath to 45o. Use a fixed antenna length of 2 m. Let σ0 be − 15 dB and use a transmitted pulse length of 1.0 μs. Assume cable and other losses of 1 dB, and use reasonable values for transmit power, noise temperature, and antenna efficiencies.

   a) Design an L -band (λ = 24 cm) system first. Achieve an SNR of > 10 dB.
   b) Reevaluate system performance at C -band (λ = 6 cm) and at K U -band (λ = 2 cm), keeping as many of the system parameters as possible unchanged from the values used in part (a). However, ensure that the swath width remains 5000 m.
   c) Contrast changes in SNR vs. frequency with the frequency sensitivity you found in question (2).