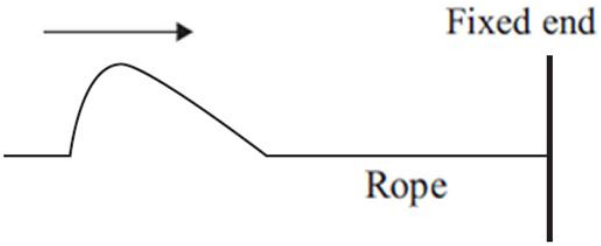
WAVES: WAVES QUESTIONS

PULSES (2010;1)

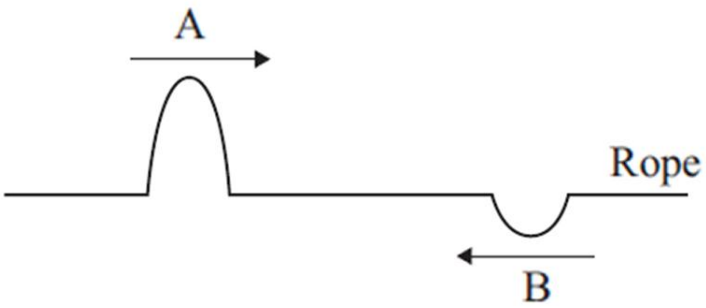
(a) Janet ties a rope to a pole and sends a pulse down the rope as shown below.



Draw a diagram in the space below to show what happens to the pulse after it reflects from the fixed end. Include an arrow to show the **direction of travel** of the pulse.

(b) Describe the changes that take place to the **speed** and **frequency** of the wave after the pulse is reflected from the fixed end.

(c) Janet and Sophie hold two ends of the rope that is stretched between them. They each send a pulse in opposite directions along the rope. The pulses are of equal width. The diagram below shows the two pulses travelling towards each other.



Pulse A is 10.0 cm high and pulse B is 4.0 cm high. Describe and explain the observations of the pulses when they meet and when they eventually pass each other.

(d) Janet and Sophie tie two different ropes together. The ropes are of different thickness. Janet sends a pulse along the rope towards Sophie.

The speed of the pulse in the first rope is 4.5 ms^{-1} and its wavelength is 12.4 cm. The wavelength of the pulse as it travels through the second rope is 8.6 cm. Calculate the speed of the pulse in the second rope.

RADIO WAVES AND LIGHT (2010;4)

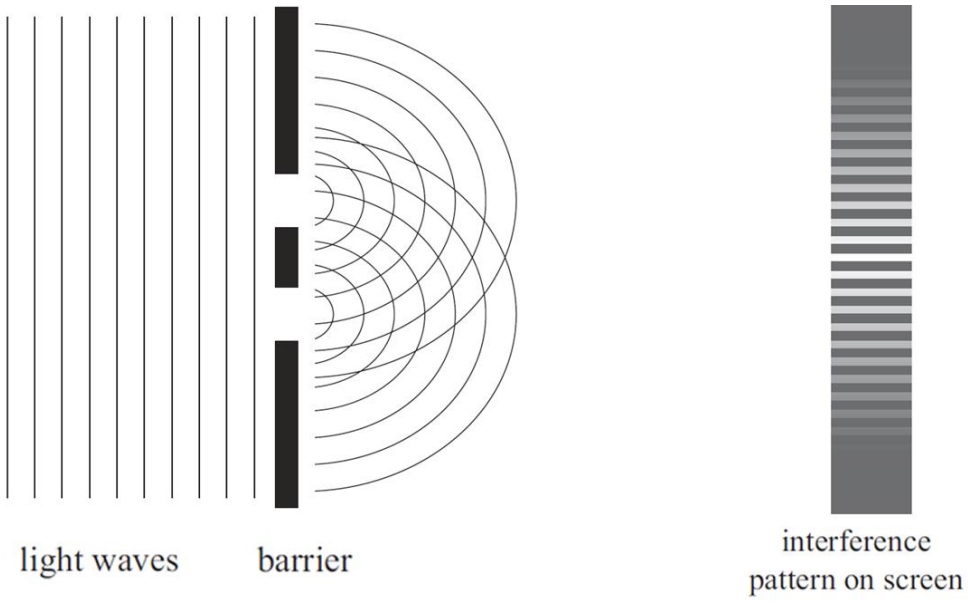
Henry listens to music on his radio while driving. There are two radio stations that he usually tunes to:

- Radio Station A, which broadcasts on its FM network using a radio wave of 93.4 MHz (93.4×10^6 Hz)
- Radio Station B, which broadcasts on its AM network using a radio wave of 856 kHz.

(a) Calculate the wavelength of the radio wave used by Radio Station A.

(b) While driving on hilly terrain, Henry notices that he can only tune into one of these two radio stations. Explain why he can hear music from only one of these two radio stations. In your answer identify which radio station he can hear, giving reasons for your answer. You may use calculations / diagrams to justify your reasoning.

Ashley shines a red laser through two slits. He obtains a pattern on a screen as shown below.

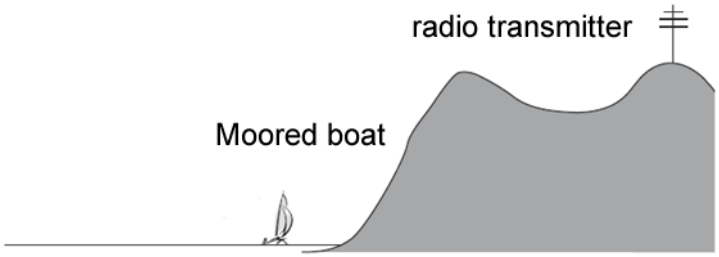


(c) Describe what would happen to the pattern if the screen was brought closer to the barrier.

(d) Explain why every alternate band is a dark band.

WAVES (2009;3)

Bianca is sitting in her boat listening to the radio. The radio signal is coming from a distant transmitter.

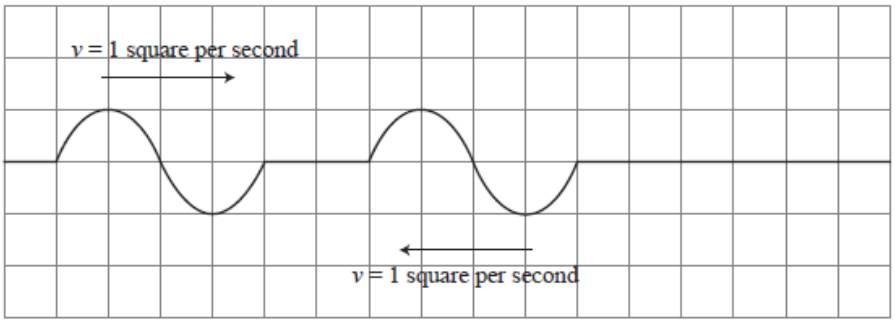


(a) Explain why the radio waves can reach her boat, even though she cannot see the transmitter.

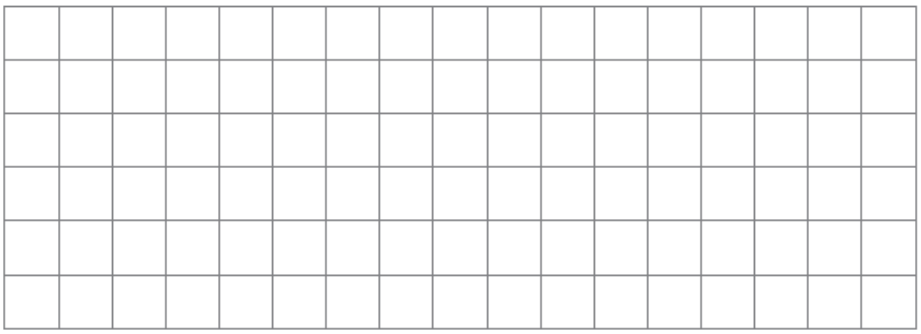
(b) Bianca is sitting on the beach listening to music. She is the same distance away from each of the two speakers. Unfortunately when she connected the speakers to the radio, she connected the wires to one speaker the wrong way round. This means the two speakers are vibrating exactly out of phase. Explain clearly what effect this will have on the sound Bianca hears.

WAVES (2008;1)

(a) While at the beach, Petra and Callum noticed two wave pulses approaching each other from opposite directions. The following diagram shows two wave pulses approaching each other at a speed of 1 square per second.

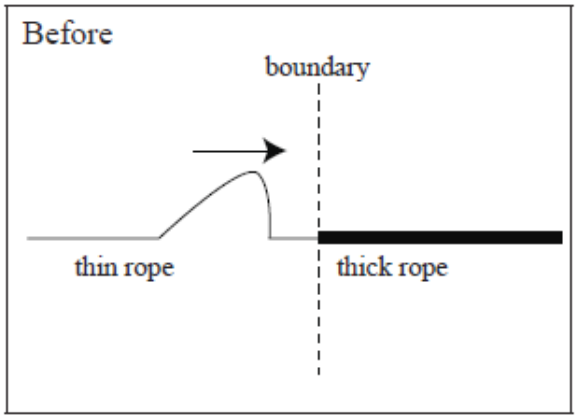


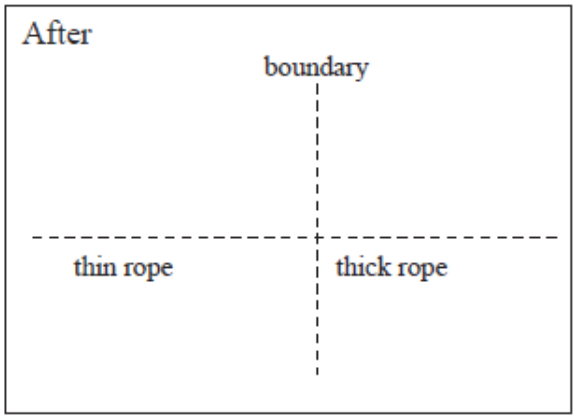
Draw the resultant of the two wave pulses 3 s later in the grid below.



Petra and Callum then played with two ropes, a thick rope and a thin rope that were joined to each other. The diagram below shows a pulse approaching a boundary between a thin rope and a thick rope.

(b) Complete the "after" diagram, showing the reflected pulse and the transmitted pulse, including the appropriate phase and pulse length.



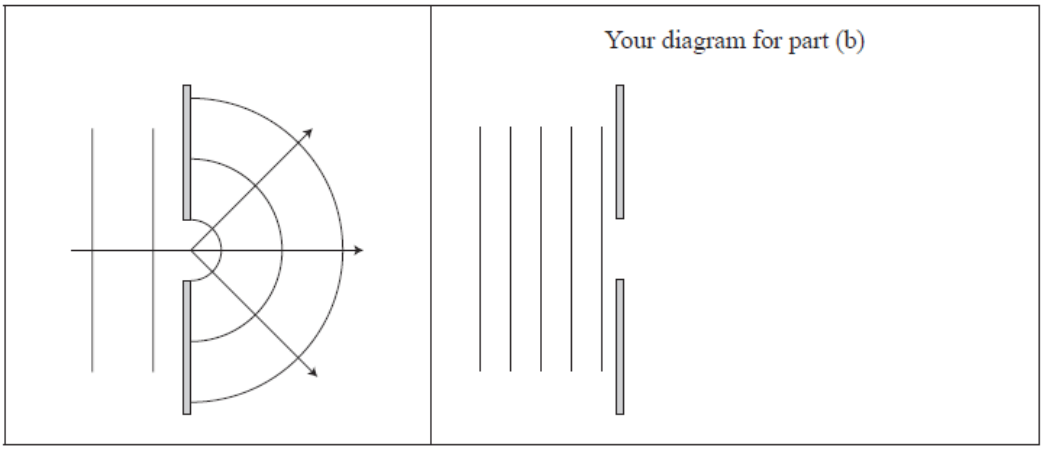


(c) The length of the pulse in the thin rope is 0.30 m. The length of the pulse in the thick rope is 0.20 m. Calculate the speed of the pulse in:
(i) the thin rope, AND
(ii) the thick rope
if the pulse travels 5.0 ms^{-1} faster in the thin rope than the thick rope.

INTERFERENCE (2008;2)

Petra and Callum went for a boat ride that took them to the famous "Hole in the Rock" located off Paihia.

The diagram shows wavefronts approaching the hole in the rock.



(a) Name the phenomenon shown in the diagram.
(b) Complete the diagram to show what would happen to the waves passing through the hole if their wavelength was much shorter.

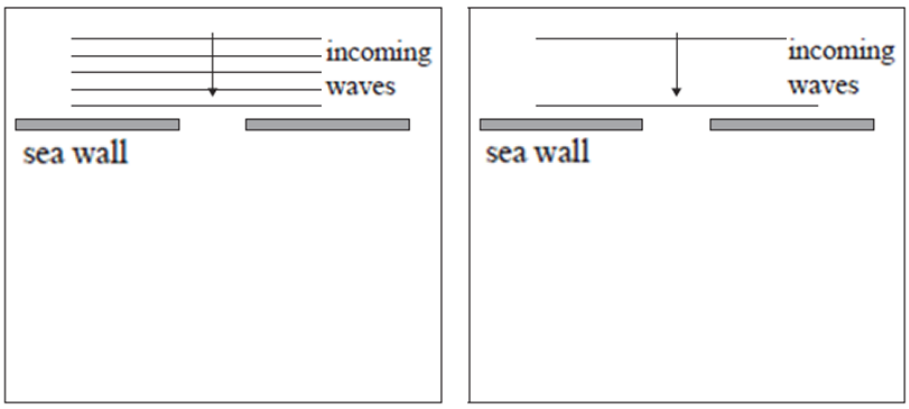
There is another large rock located fairly close to the hole in the rock. At high tide, wavefronts approach and pass through both gaps coming towards the boat from which the photograph below was taken.

(c) A black sea-bird is on the water at a distance of 20 m from one gap and at a distance of 22 m from the other gap. The wavelength of the ocean waves is 4.0 m. Explain how these waves affect the motion of the black sea-bird on the water.

AT THE HARBOUR (2007;2)

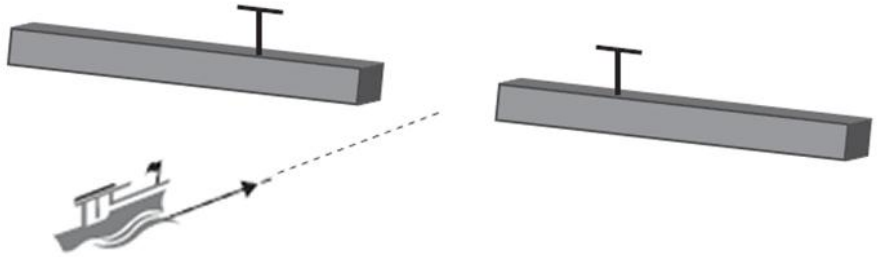
The sea wall has a gap to allow boats to pass though. Maria watches the waves as they come through the gap. She notices that the behaviour of the waves depends on their wavelength.

(a) Draw the wave patterns she would observe in each situation shown below.



(b) State the name of this phenomenon.

Maria notices a radio transmitting aerial either side of the harbour entrance. She is told that these are to guide boats through the centre of the entrance. They both transmit the same frequency radio wave. The waves are in phase. Boats equipped with radios pick up the waves and travel along the path where the signal is strongest.



(c) If a boat travels along the central path, it receives a strong radio signal. If the boat moves to one side of the central path, the amplitude of the radio waves received decreases. Clearly explain these two observations.

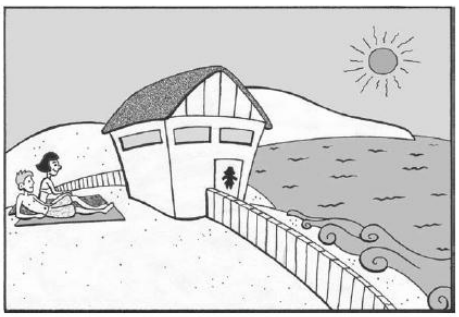
The radio waves used have a period of 0.035 ms. The speed of light is 3.00×10^8 ms^{-1}.

(d) Calculate the number of complete waves emitted by an aerial each second.
(e) Calculate the distance a wave crest moves during one period. Write your answer to the correct number of significant figures.

Waves (2006;1)

Roy and Sally spent time on a beach watching the incoming waves.

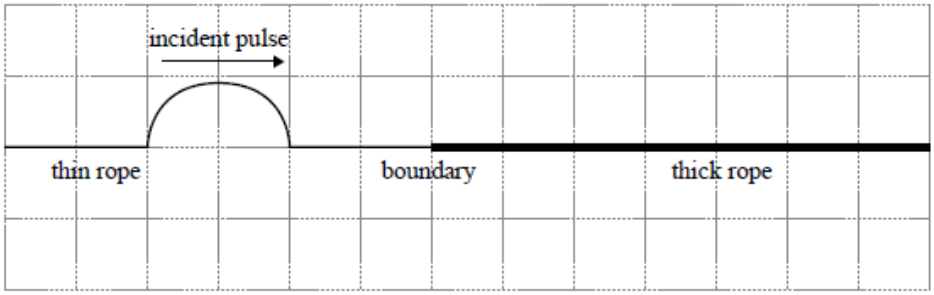
(a) Roy counted 8 complete waves passing a fixed point in 20 seconds. Calculate the frequency of the waves.
(b) State two possible units for frequency.
(c) The speed of the waves in the water is 2.8 ms^{-1} Calculate the wavelength of these waves.



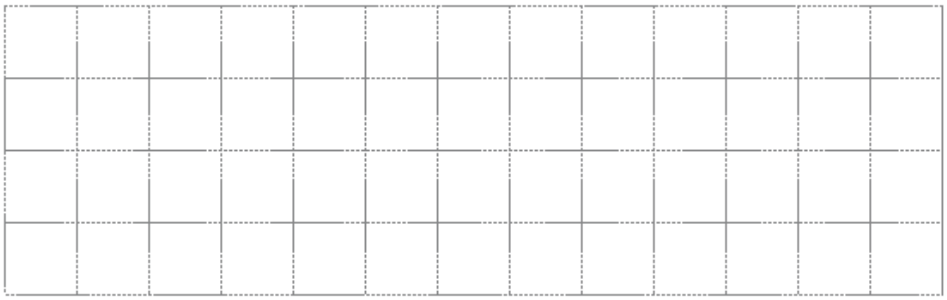
(d) Give a physics reason why Roy and Sally could hear the sound of the waves when they were sitting behind a building at the beach, even though they could not see the waves.
(e) State TWO important physical differences between sound waves and light waves.

Roy and Sally took skipping ropes to the beach. One rope was thicker than the other. They tied the two ropes together. Roy held the thin rope and gave it a flick so that a pulse travelled along the thin rope towards the thick rope as shown in Box One below.

Box One

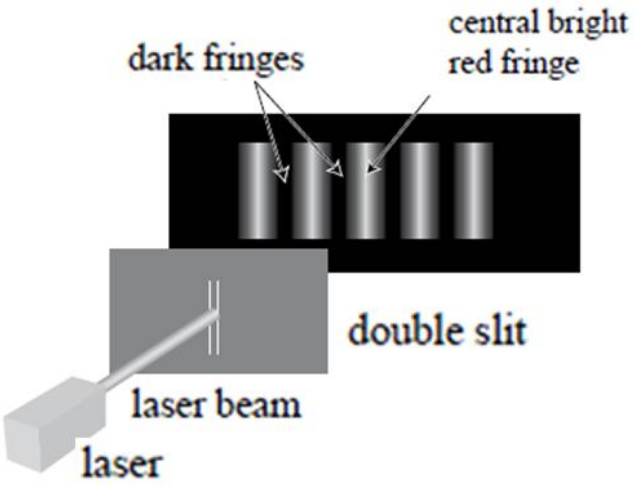


(f) Draw a diagram in Box Two below, to show the reflected and refracted pulses after the pulse hits the boundary (the pulse travels faster in the thin rope).



Light (2006;2)

Roy and Sally later shone a red laser beam through two narrow slits. They saw a pattern formed on the wall as shown in the diagram below.



(a) State a name given to the bright fringe.
(b) Explain clearly why there are dark fringes on either side of the central bright fringe on the wall.

QUESTION THREE (2005;3)

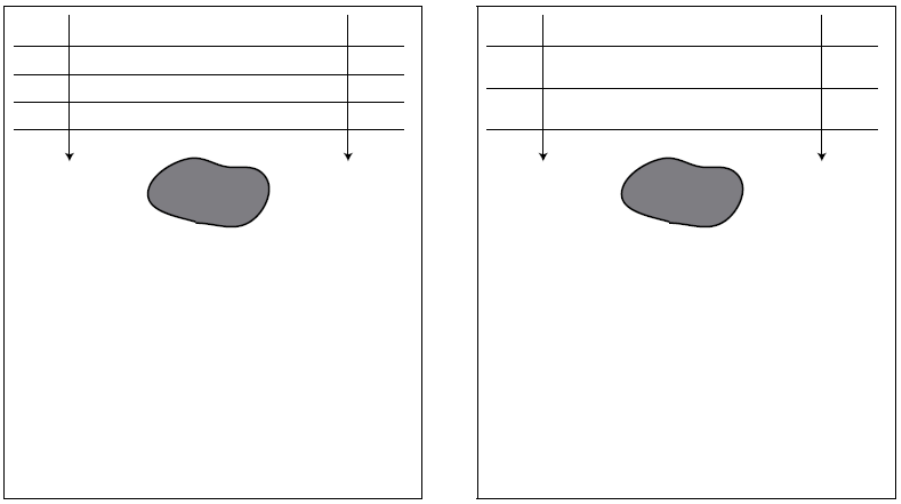
Robbie is sitting beside the outside pool listening to music. His radio receives radio waves and produces sound waves. (v_{light} = 3.0 x 10^8 ms^{-1})
The dial shows that he is tuned to 91.0 MHz.

(a) State one important difference between radio waves and sound waves.
(b) The radio wave is produced by making electrons oscillate up and down inside an aerial. Calculate how long it will take one of the electrons to oscillate up and down once.
(c) Calculate the wavelength of the radio wave. Write your answer to the correct number of significant figures.
(d) The radio's speaker cone causes the air molecules to vibrate. Each molecule moves a total distance of 1.0 cm every oscillation. Calculate the amplitude of an oscillation.

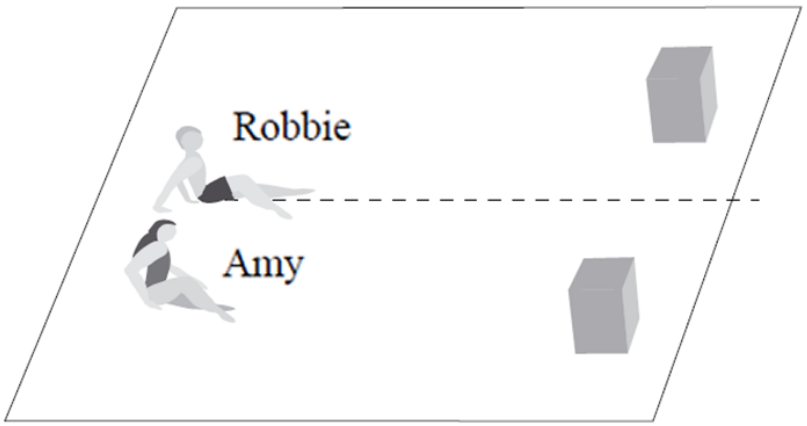
QUESTION FOUR (2005;4)

Robbie and Amy are sitting beside the children's pool. The children's pool has an island in it. Waves travel past the island as shown in the diagrams below. Robbie looks at the shape of the waves after they pass the island. He notices that the wave behaviour depends on the wavelength.

(a) Draw the wave patterns he would observe as the waves pass the island in each case.



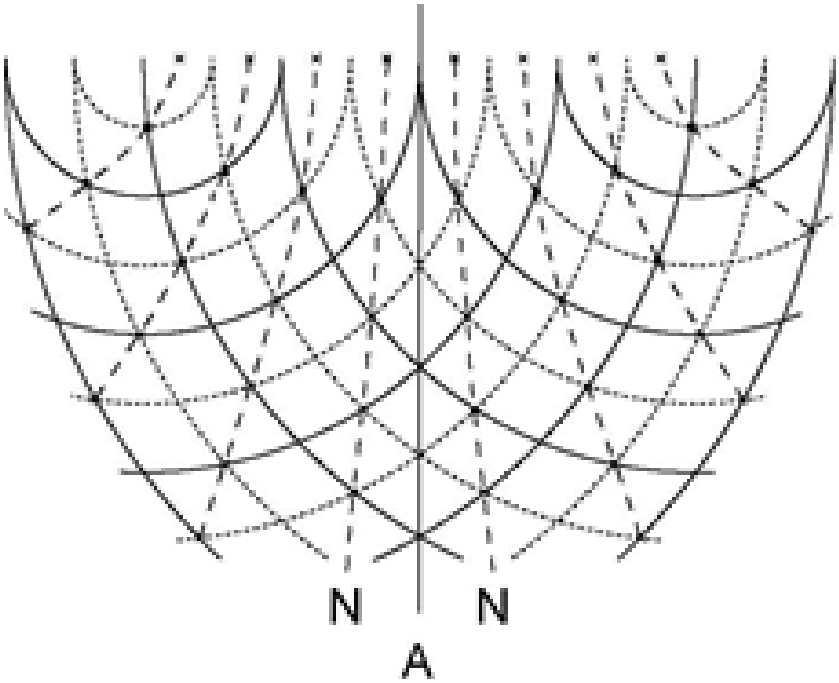
(b) State the name of this phenomenon.
(c) There are two speakers on the grass area by the pool. The speakers are producing the same constant frequency sound. Robbie and Amy are sitting facing them as shown. Robbie complains that the sound is loud but Amy observes it to be quiet. Explain clearly how interference could cause this to happen.



WAVES (2004;2)

Mere is now on holiday, and she is sitting in a boat that is stationary on a calm lake. There are two outboard motors at the back of the boat. These motors have been pulled up out of the water. Drops of water are dripping from both motors at the same time and at the same constant rate onto the surface of the lake.

Mere looks down and sees that the resulting pattern of waves produced by the dripping water is as shown below. The interference pattern has nodal lines (N) and antinodal lines (A)



(a) The surface of the water remains approximately flat along a nodal line. Explain clearly why this is so.

(b) After a while, the frequency of the dripping water from both sources is halved. Describe what effect this change will have on the wavelength and on the pattern of the nodal lines.

(c) A wind begins to blow producing straight waves on the surface of the lake. Mere watches what happens to the waves as they go past a stone wall in the water. Complete the above diagram by drawing carefully the appearance of the wave crests as they continue to the right of the three crests already shown. Indicate the direction(s) of the waves that you draw.

(d) Name this phenomenon.

(e) If the crests of the waves are 1.3 m apart and they are travelling at a speed of 2.0 ms^{-1} calculate the frequency of the waves. Give a unit with your answer.

(f) Mere was studying straight waves in a different part of the lake. Using a stopwatch, she counted 12 complete waves passing her in 56.7 seconds. She estimated that the distance occupied by the 12 complete waves was 48 m. Calculate the speed with which the waves were travelling. Give your answer to the correct number of significant figures.