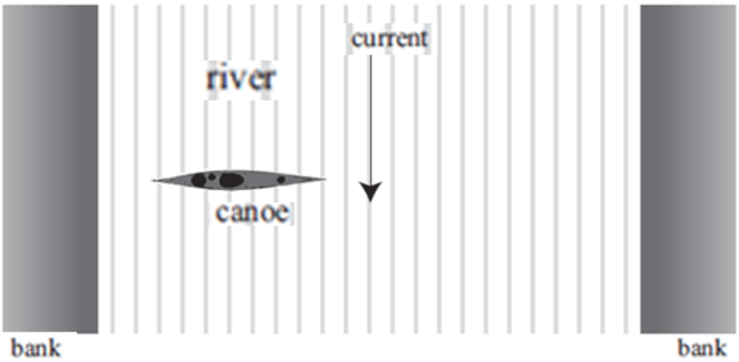
MECHANICS: VECTORS QUESTIONS

RELATIVE VELOCITY AND PROJECTILES (2009;2)



Jordan uses a canoe to cross a river that is 45 m wide. There is a current flowing with a speed of 0.67 ms^{-1} as shown in the diagram.
Jordan paddles with a speed of 1.39 ms^{-1} relative to the water.
Jordan wants to paddle the canoe so it moves at right angles to the bank and lands straight across from where it started.

(a) Draw a labelled vector diagram showing the direction Jordan must point the canoe, in order to land straight across on the other side. Your diagram should have each of the following named clearly: the velocity of the current, the velocity of the canoe relative to the water, the velocity of the canoe relative to the ground (No calculations are necessary).

(b) Jordan points the canoe so that it lands straight across from where it started. Calculate the time it takes to cross the river.

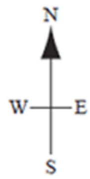
THE AIRCRAFT (2007;1)

An aircraft is flying at a height of 600 m above the ground.

(a) Explain why the aircraft flying is not an example of projectile motion.

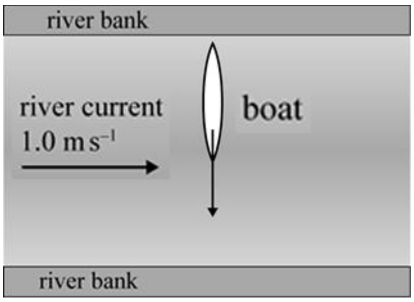
(b) While the aircraft is flying horizontally at a speed of 35 ms^{-1}, a packet is dropped from it. Calculate the speed of the packet when it reaches the ground (include a vector diagram).

(c) The aircraft has a new constant horizontal airspeed of 100 ms^{-1}. The pilot wants to fly directly east, but there is a wind blowing from the north with a speed of 40 ms^{-1}. Draw a labelled vector diagram showing the direction in which the pilot must point the aircraft. Use the diagram to calculate the angle between the aircraft and north (the bearing).



ROWING (2006;1)

Steve is in a rowing race. At the end of the race, Steve rows across a part of the river where there is a current flowing at a speed of 1.0 ms^{-1}. Steve points his boat at right angles to the river bank. His speed through the water is 3.0 ms^{-1}.

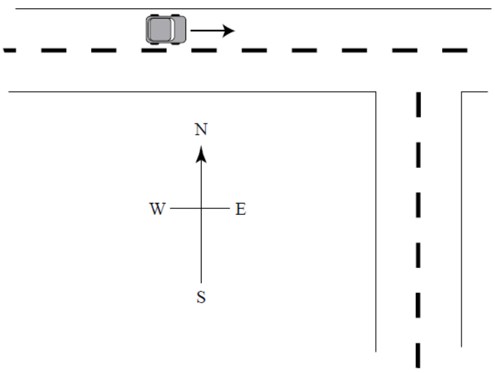


(a) Draw a velocity vector diagram showing the direction the boat travels. Use the diagram to calculate the boat's resultant speed. Calculate the angle between the river bank and the boat's velocity.

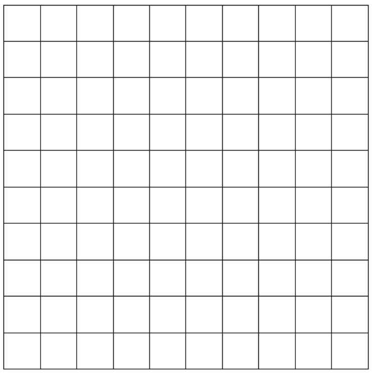
Draw your vector diagram here.

TRAVELLING BY CAR (2005;1)

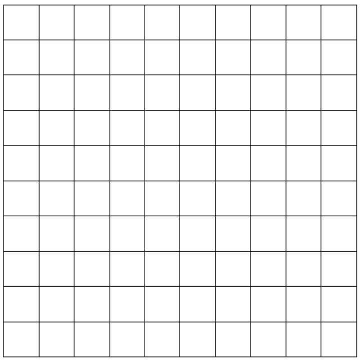
(a) Some time later the car is travelling in an easterly direction with an initial velocity of 12 ms^{-1}. It makes a right hand turn, and then travels south with a final velocity of 16 ms^{-1}.



(i) On the grid below, using a scale of 1 cm = 2 ms^{-1}, draw labelled vectors to represent the initial and final velocities of the car.



On the grid below, using a scale of 1 cm = 2 ms^{-1}, draw a labelled vector diagram showing the change in velocity of the car.

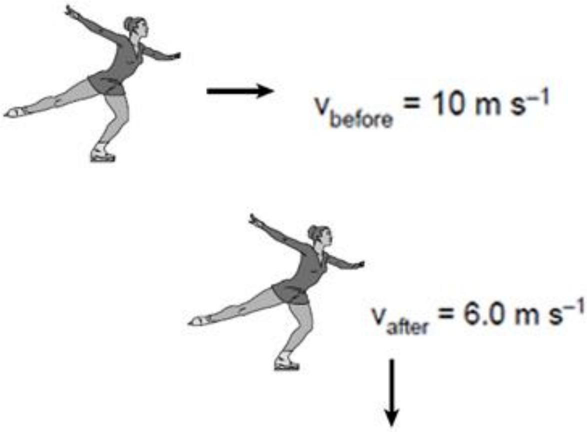


(ii) Calculate the size of the change in velocity of the car.

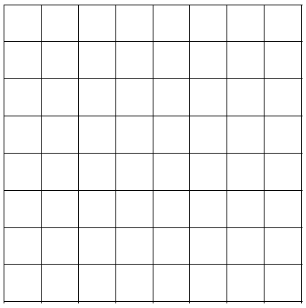
(iii) Calculate the direction of the change in velocity of the car.

SCHOOL TRIP - ICE SKATING (2004;4)

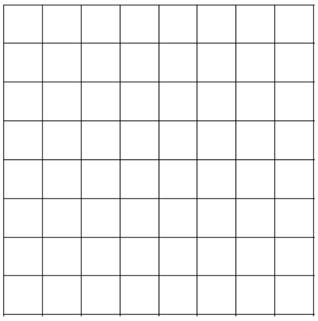
Ana is warming up on the ice. She skates in a straight line at a speed of 10 ms^{-1} and then she changes her speed to skate at a speed of 6.0 ms^{-1} at right angles to her original direction, as shown in the diagram below.



(a) On the grid below, and using the scale given, draw labelled arrows to show (i) Ana's initial velocity (ii) Ana's final velocity using a scale: 1 square = 2 ms^{-1}



(b) On the grid below, draw a vector diagram to show the change in Ana's velocity. Scale: 1 square = 2 ms^{-1}



Use your vector diagram to calculate the size and the direction of the change in Ana's velocity. Show clearly on your diagram which angle you have calculated.