Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Mechanics Assignment 2

Vectors, relative velocity

Level 2

90255 Demonstrate understanding of mechanics

You may find the following formulae useful

$$v = \frac{\Delta d}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t} \qquad v_f = v_i + at$$

$$d = v_i t + \frac{1}{2}at^2 \qquad d = \frac{v_i + v_f}{2}t \qquad v_f^2 = v_i^2 + 2ad$$

$$a_c = \frac{v^2}{r}$$

$$F = ma \qquad \tau = Fd \qquad F = -kx$$

$$F_c = \frac{mv^2}{r} \qquad p = mv \qquad \Delta p = F\Delta t$$

$$E_p = \frac{1}{2}kx^2 \qquad E_k = \frac{1}{2}mv^2 \qquad \Delta E_p = mg\Delta h$$

$$W = Fd \qquad P = \frac{W}{t}$$

$g = 9.8 ms^{-2}$

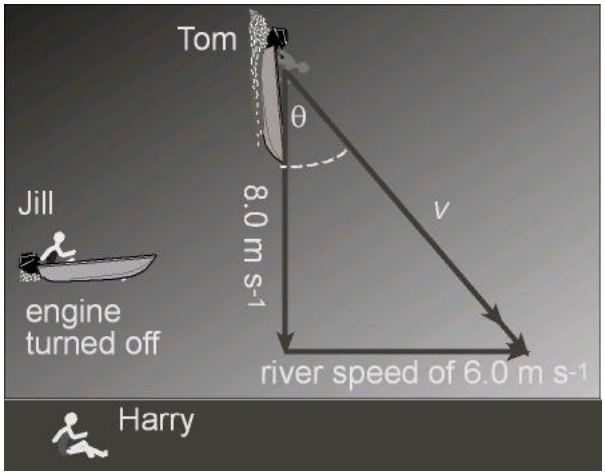
NZIP 2007

QUESTION ONE: BOATING

Tom and Jill are paddling a canoe across a lake. The **total mass** of Tom, Jill and their boat is 190 kg.

The diagram shows Tom, travelling directly across a river in a jet boat, at a speed of 8.0 m s^{-1}. Jill is sitting in her boat floating on the river with her engine turned off. Harry is sitting on the river bank watching both boats.

The speed of the river is 6.0 m s^{-1} in a direction to the right.



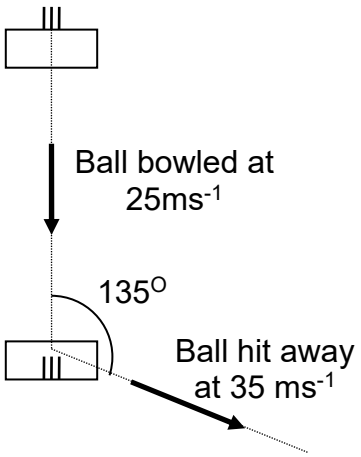
(e) Calculate the **resultant speed** v and direction Φ of Tom's boat, as shown in the diagram.

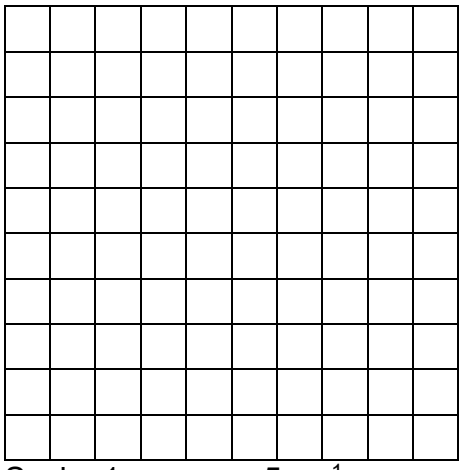
(f) Describe the speed and direction of Tom's boat as seen by Harry sitting on the river bank.

(g) Describe the speed and direction of Tom's boat as seen by Jill sitting in her boat floating on the river with her engine turned off.

NZIP 2006
QUESTION THREE: BIG HITTER (CRICKET)

(a) The next batter hits a bowl away to the right. The ball was bowled at **$25ms^{-1}$** and hit away at **$35ms^{-1}$**. The ball travelled away at an angle of **135^O** from the angle the ball was bowled. Complete the vector diagram to find the change in velocity.





Scale: 1 square = $5ms^{-1}$

Change in velocity = _____

Direction of change =_____

(b) Later the batter hit the ball into the air. The ball left the bat travelling at a speed of **$36ms^{-1}$** and at an angle of **43^O** to the ground.

(i) Show that the initial vertical velocity of the ball is $24.55ms^{-1}$ (unrounded).

_____

_____

(ii) Show that the initial horizontal velocity of the ball is $26.33ms^{-1}$ (unrounded).

_____

_____