Question Number	Answer	Mark
7(a)	Velocity $(-3\mathbf{i}+\mathbf{j})$	B1
	Speed $\sqrt{(-3)^2+1^2}$	M1
	$=\sqrt{10}$, 3.2 or better (km h^{-1})	A1
		(3)
7(b)	Find difference between the position of the boat at time *t* and *A* $[(4-3t)\mathbf{i}+(2+t)\mathbf{j}]-(2\mathbf{i}-\mathbf{j})$ $\{=(2-3t)\mathbf{i}+(3+t)\mathbf{j}\}$	M1
	Method using direction to form equation in *t* only	dM1
	Correct equation in *t* eg • $\frac{3+t}{2-3t}=-1$ • $3+t=3t-2$	A1
	t = 2.5	A1
	1630 or 4:30 pm	A1
		(5)
		(8)
	Notes for Question 7	
	Accept column vectors throughout	
7(a)		
B1	Seen or implied.	
M1	Use of Pythagoras with the square root of *their* velocity to find a numerical speed.	
A1	Correct answer, isw	
7(b)		
M1	Method to find the difference between $(2\mathbf{i}-\mathbf{j})$ and the position vector of the boat at time *t*. Condone subtraction either way round but M0 for addition. M0 if $(2-3t)\mathbf{i}+(-1+t)\mathbf{j}$ is seen without a valid method using subtraction.	
dM1	Dependent on previous M. Method using the bearing to form an equation in *t* only, allow with ± 1 for the method mark only. Must use their difference with **i**' and **j**'s collected.	
A1	Correct equation in *t* only	
A1	*t* = 2.5, seen or implied	
A1	Correct time, condone 16:30pm. 4.5 is A0	

8.

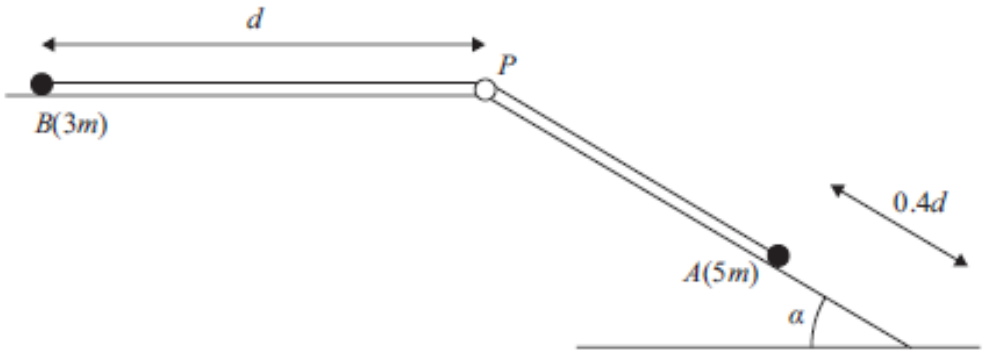


Figure 4

One end of a light inextensible string is attached to a particle A of mass $5m$. The other end of the string is attached to a particle B of mass $3m$. Particle A lies on a **smooth** plane that is inclined to horizontal ground at an angle α, where $\tan\alpha = \frac{3}{4}$. Particle B lies on a **rough** horizontal plane. The string passes over a small smooth pulley P that is fixed at the top of the inclined plane.

The two particles, the string and the pulley all lie in the same vertical plane.
The portion of the string between A and P lies along a line of greatest slope of the inclined plane. The portion of the string between B and P is horizontal.

The system is held at rest with $BP = d$ and particle A at a distance $0.4d$ from the bottom of the inclined plane, as shown in Figure 4.

The coefficient of friction between B and the horizontal plane is 0.2

The system is released from rest with the string taut and A begins to move down the inclined plane.

(a) Find, in terms of m and g, the magnitude of the frictional force acting on B.

(2)

By writing down an equation of motion for each particle,

(b) show that the acceleration of A down the inclined plane is $0.3g$

(5)

(c) State how you have used the fact that the string is inextensible in your working for part (b).

(1)

When A hits the ground at the bottom of the inclined plane it stops.

(d) Show that B comes to rest just as it reaches the pulley.

(5)