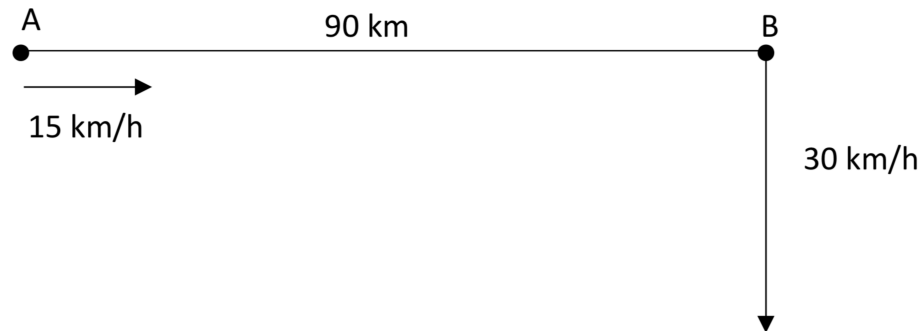
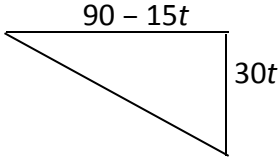


Question 9**(25 marks)**

Two ships set sail at the same time, Ship A from Port A and Ship B from Port B. Port A is 90 km due west of Port B, as shown below. Ship A is traveling due east at a speed of 15 km/h. Ship B is travelling due south at a speed of 30 km/h.



- (a) Find the distance between the two ships 30 minutes after they set sail. Give your answer in km, correct to 2 decimal places.
- (b) t is the time in hours after the ships set sail. Show that the distance between the ships at time t can be given by the function
- $$s(t) = (1125t^2 - 2700t + 8100)^{\frac{1}{2}},$$
- where $0 \leq t \leq 6$.
- (c) Use calculus to find the value of t when the ships are closest to each other, **and** find the distance between the ships at your value of t . Give the distance in km, correct to 1 decimal place.

Q9	Model Solution – 25 Marks	Marking Notes
(a)	$d = \sqrt{\left(90 - \frac{15}{2}\right)^2 + \left(\frac{30}{2}\right)^2}$ $d = \sqrt{(82.5)^2 + (15)^2}$ $d = 83.85 \text{ km}$	<p>Scale 15C (0, 5, 10, 15) <i>Low Partial Credit:</i> $\frac{15}{2}$ or $\frac{30}{2}$ Indication of Pythagoras</p> <p><i>High Partial Credit:</i> Pythagoras fully substituted</p>
(b)	 $s^2 = (90 - 15t)^2 + (30t)^2$ $s^2 = 8100 - 2700t + 225t^2 + 900t^2$ $s^2 = 1125t^2 - 2700t + 8100$ $s = (1125t^2 - 2700t + 8100)^{\frac{1}{2}}$	<p>Scale 5C (0, 3, 4, 5) <i>Low Partial Credit:</i> 90 – 15t or 30t</p> <p><i>High Partial Credit:</i> Pythagoras fully substituted</p>
(c)	$s = (1125t^2 - 2700t + 8100)^{\frac{1}{2}}$ $\frac{ds}{dt} = \frac{(2250t - 2700)}{2\sqrt{1125t^2 - 2700t + 8100}}$ $\Rightarrow 2250t - 2700 = 0$ $t = \frac{2700}{2250} = 1.2 \text{ hours}$ $s = (1125t^2 - 2700t + 8100)^{\frac{1}{2}}$ $s = (1125(1.2)^2 - 2700(1.2) + 8100)^{\frac{1}{2}}$ $s = 80.4984 \approx 80.5 \text{ km}$	<p>Scale 5D(0, 2, 3, 4, 5) <i>Low Partial Credit:</i> Any correct differentiation</p> <p><i>Mid Partial Credit:</i> Value of t found</p> <p><i>High Partial Credit:</i> Formula for s fully substituted Incorrect value of t (found through calculus) substituted and worked correctly.</p> <p>Note: No calculus \Rightarrow 0 credit</p>