Mathematics Specialist Unit 1 Name:……………......

 **Test 1a 2018 (wk4)**

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| **/27** |

This test is Calculator Assumed; CAS calculators and 1 sheet of notes (A4 size) are allowed.

**Marks Available: 27 marks Time Allowed: 30 minutes**

1. **[4 marks: 2, 2]**

Vectors **a** and **b** are as shown on the grid below.



1. On the grid above, sketch and label the vectors ***p q*** such that:

***P = 2a+b***

***Q = -3b-0.5a***

1. Show on the diagram vectors **a** take **b** can give the resultant vector **y**?
2. **[4 marks]**

Two tug boats are pulling a platform with forces 20N and 35N. There is an angle of 40 between their directions. What is the magnitude of the resultant force and the angle it makes with the larger of the forces?

1. [6 marks: 3, 3]

Three vectors are given by , and .

**a)** Determine

**i)** .

**ii)** .

**iii)** .

**b)** Determine the unit vector that is parallel and in the same direction as .

1. **[8 marks: 2, 3, 3]**

A seaplane with a cruising speed of 250 kmh-1 is required to fly to a location 355 km away on a bearing of 305°. A wind of 36 kmh-1 is blowing on a bearing of 200°.

**a)** Sketch a diagram to show this information.

**b)** Determine the bearing that the seaplane should steer.

**c)** Determine the flight time, in hours and minutes.

1. **[5 marks]**

A drone flies with a constant velocity and height above level ground, over which a wind blows from the north west at 3.5 metres per second. After 15 seconds, the drone reaches a point 85 metres on a bearing of 020° from where it was launched.

Determine the velocity of the drone, giving its magnitude to two decimal places and bearing to the nearest degree.

**END OF TEST**

Mathematics Specialist Unit 1 Name:……………......

**Test 1b 2018 (wk7)**

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| **/28** |



This test is Calculator Assumed; CAS calculators and 1 sheet of notes (A4 size) are allowed.

**Marks Available: 28 marks Time Allowed: 35 minutes**

1. **[5 marks: 1, 2, 3]**

A drone has an initial position vector of  metres with respect to an origin O and flies with a constant velocity of  metres/second.

1. What is the speed of the drone?
2. What will be its position vector after 5 seconds and how far will it be from the origin?

1. After how many seconds will the drone be 50 metres from the origin?
2. [9 marks: 1, 3, 5]

Three vectors are given by , and , where is a constant.

1. Determine the scalar product of a and b.
2. Determine the vector projection of on .
3. Determine the value(s) of if

**i)** and are perpendicular.

**ii)** the angle between the directions of and is 45°.

7. [9 marks: 4, 5]

**a)** The work done, in joules, by a force of Newtons in changing the displacement of an object by metres, is given by the scalar product of and .

i) A force of 250 N acting due south moves an object 4.3 m in a south-westerly direction. Determine the work done.

ii) Another force of 155 N does 269 joules of work in moving an object 190 cm. Determine the angle between the force and the direction of movement.

**b)** A triangle is formed by three non-zero vectors , and , so that , and is the angle between and .

i) Sketch the triangle.

ii) Explain why .

iii) Use to deduce the cosine rule.

1. **[5 marks]**

Determine the value of P in Newtons and the bearing of P such that the system is in equilibrium.

