**Chapter 3: Vectors in the plane Test A** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Simple familiar*

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|  | Using the vectors shown, sketch the result of: a.  b.  c.  c. | [1 mark per correct vector sketched] | 4 |
|  | The hexagon ABCDEF at right can be defined by the four vectors , , and . Describe in terms of these four vectors:   1. the vector from A to F 2. the vector from A to E 3. the vector from F to D. | 1. [1 mark] 2. [1 mark] 3. [1 mark] | 3 |
|  | A boat sails 15 km north and 8 km east.   1. Sketch a vector drawing of the path of the boat. On the same grid, sketch the vector that represents the net displacement of the boat. 2. Determine the magnitude of the net displacement. 3. Calculate the bearing (clockwise from true north) of this net displacement vector. | 1. [1 mark for the vector drawing of the path, 1 mark for the net displacement] 2. The net displacement vector has a magnitude of km. [1 mark] 3. .  The net displacement vector (in the first quadrant) has a direction of therefore its bearing (clockwise from true north, is  [1 mark] | 4 |
|  | A student rides their bicycle 5 km south-east and then 12 km north-east.   1. Determine how far the student is from their starting point. 2. Determine how far east the student is from their starting point. 3. Determine how far north the student is from their starting point. 4. Calculate the bearing (clockwise from true north) of the net displacement vector. Give your answers to two decimal places where appropriate. | 1. Let’s sketch a vector drawing of the bycicle ride, with  and  corresponding to the first leg and second leg of the journey respectively, and  being the net displacement vector.  How far the student is from their starting point is given by the magnitude of the net displacement vector.  The student is  from their starting point. [1 mark] 2. The total distance east from the staring point is given by .  The student is 12.02 km east of their starting point [1 mark]. 3. The total distance north from the staring point is given by. The student is 4.95 km north of their starting point [1 mark]. 4. The direction  of the dispacement vector (in the first quadrant) is such that  thus . The bearing (clockwise from North) is therefore  [1 mark]. | 4 |
|  | Consider the following relationships between  and :  .   1. Determine the scalar  so that . 2. Determine the scalar  so that . |  | 2 |
|  | Determine the direction and magnitude of a vector joining point A to point B, where B is 12 m south and 7 m east of A. Give your answers to one decimal place. | is in the fourth quadrant thus its direction is given by .  Therefore, has a magnitude of  [1 mark] and a direction of  [1 mark]. | 2 |
|  | An ant walks the following route: 40 cm south east — 20 cm north east — 30 cm west.  Determine the magnitude and direction of the net displacement vector. Give your answers to one decimal place. | The net displacement vector is    The net displacement vector, which is in the fourth quadrant, has a magnitude is cm [1 mark] and a direction of  [1 mark]. | 2 |
|  | Determine the magnitude and direction of the following vectors. Give your answers to two decimal places where appropriate. | 1. has a magnitude of  [1 mark] and a direction (is in the first quadrant) of  [1 mark]. 2. has a magnitude of  [1 mark] and a direction (is in the fouth quadrant) of  [1 mark]. 3. has a magnitude of  [1 mark] and a direction (is in the third quadrant) of  [1 mark]. 4. has a magnitude of  [1 mark] and a direction (is in the second quadrant) of  [1 mark]. | 8 |
|  | Express the following vectors in polar form. Give your answers to two decimal places where appropriate. |  | 2 |
|  | Express  in Cartesian form for the following cases. Give your answers to two decimal places where appropriate.   1. has a bearing of  from N and a magnitude of 12. 2. has a bearing of from N and a magnitude of 4. 3. has a bearing of from N and a magnitude of 8. | 1. A bearing of  clockwise from N correspond to a direction of  anticlockwise from the positive direction of the -axis. Thus 2. A bearing of  from N correspond to a direction of  anticlockwise from the positive direction of the -axis. Thus 3. A bearing of  from N correspond to a direction of  anticlockwise from the positive direction of the -axis. Thus | 3 |
|  | Determine a unit vector in the direction of each the following vectors. Give your answers in exact form. |  | 4 |
|  | For each of the following pairs of points A and B, express  in polar form. Give your answers to two decimal places where appropriate.   1. and 2. and 3. and | is in the second quadrant thus its direction is .        is in the first quadrant thus its direction is .        is in the first quadrant thus its direction is .      is in the fourth quadrant thus its direction is . | 4 |

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|  | Given that the distancebetween two vectors  and  is , calculate the distance between this pair of vectors:  and . Give your answer to two decimal places. |  | 3 |
|  | Let  and  where  is a scalar.  Determine the coordinates of  such that  is a square. | is a square if it is a parallelogram, that is and , and if its diagonals are of equal length, that is . [1 mark]  Using :  (We can verify that using yields the same information)  Using :    Therefore, . | 4 |
|  | Let  and  where  is a positive scalar. Determine  such that the distance between vectors  and  , , is .Give your answer to two decimal places. |  | 2 |
|  | Let  and the middle of segment . Let  be the point such that  Show that the points  and D are aligned. | the middle of segment  thus      and  are aligned if  such that  [1 mark].    thus the points  and  are aligned [1 mark]. | 5 |

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|  | Let  and . Determine the linear relationship between  and  such that the lines  and  are parallel. | The lines  and  are parallel if the vectors  and  are colinear, that is if  such that  [1 mark]. | 3 |
|  | A boat travels west at 12 km/h, while another boat travels north at 35 km/h. Determine the bearing of the difference vector. Give your answer to two decimal places. | Let vectors and be the net vector displacement for the first and second boat respectively.        Let  be the direction of    is in the fourth quadrant thus its direction is  anticlockwise from the positive direction of the -axis and its true bearing (clockwise from north) is . [1 mark] | 2 |
|  | Two bushwalkers starts their hike from the same starting point. The first one walks south-west and then  north-east while the second one walks north-west and then  east.  Given that the distancebetween two vectors  and  is , and that the final distance between the two bushwalkers is , determine the value of to two decimal places | The first bushwalker net vector displacement is .  The second bushwalker net vector displacement is .  The final distance between the two bushwalkers is  is a distance, thus only the positive root of the quadratic equation is considered. | 5 |
|  | If  and ,  and , determine the values of  and . | Thus we have to solve the following system:    By substituting  in the second equation, we obtain . And by substituting  in the first equation, we obtain .  Therefore,  [1 mark] and  [1 mark]. | 4 |