**Chapter 4: Algebra of Vectors Test A** Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**in two dimensions**

*Simple familiar*

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|  | If  = 4 − 3 and  = 2 + 4, then determine the vector 4 − 2.5 . |  |  |
|  | Which of the following vectors has magnitude 25?  A  B  C  D |  |  |
|  | If  = 3 + 4and *v* *=* −4 + 5, then calculate the value of . |  |  |
|  | Evaluate the size of angle between   = 3 + 4 and  *=* −4 + 5,  correct to 2 decimal places. |  |  |
|  | Determine a unit vector perpendicular to  −3 + 4. |  |  |
|  | TY08-03  The 3-kg object is in equilibrium on a smooth plane.  Express the magnitude of forces and in terms of *g*. |  |  |
|  | A cart of mass 16 kg is dragged across a horizontal floor at a constant speed of 1 m/s by a force of 100 N acting at an angle of 20° to the horizontal. Calculate the value of the coefficient of friction, leaving your answer in exact form. |  |  |
|  | Two forces,  and , act simultaneously on an object.   1. Calculate the magnitude of the resultant force. 2. Determine the direction of the resultant force |  |  |
|  | A windsurfer heads due east at 24 km/h with respect to the water but is pushed off course by a 15-km/h wind from the north. Determine the velocity of the windsurfer as seen by an observer on the shore. |  |  |
|  | Given  *=*  + 2 and  *=* 2 + 3, determine the vector resolute of  parallel to  . |  |  |
|  | In the diagram shown, D is the midpoint of CB and E is the midpoint of AD. The position vectors of points A, B, C, D and E are given by , , ,  and  respectively.  TY08-1-1  Express the value of , the position vector of D, in terms of the vectors  and . |  |  |
|  | Let (*t*) be a position vector of an object whose position varies with time. If   *=* 3 sin *t* *+* 3 cos *t*  then the path this object takes is:   1. a straight line 2. a parabola 3. an ellipse 4. a circle |  |  |

*Complex familiar*

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|  | If  and , determine  if:   1. and  are parallel 2. and  are perpendicular 3. and  are equal in length 4. the scalar resolute of  on  is . |  |  |
|  | Let  ***=*** 5 + 3 and  **=**  **+** 2.   1. Calculate the angle between the two vectors, in radians, to 4 decimal places. 2. Find , the angle which  makes with the *x*-axis, in radians rounded to 4 decimal places. 3. Find the vector resolute of  in the direction of . |  |  |
|  | A 4-kg mass is placed on a smooth inclined plane and a force of magnitude 24 N acting up the plane is applied. If the plane is inclined at 30° to the horizontal, calculate:  (a) the component of the weight acting down the plane  (b) the normal reaction  (c) the resultant force. |  |  |
|  | Let  *=* 2 *+* 4. Determine a vector, parallel to , such that their dot product is 40. |  |  |

*Complex unfamiliar*

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|  | The three forces shown in the figure below are acting such that the particle is in equilibrium. Calculate the angle between the forces with magnitude *F* N and 16 N.  SM Test Yself fig 45 |  |  |
|  | Calculate the equation of the path of the *time-varying* position vector  ***=***  ***+*** 2 (*t*2 − 1). State the type of path (linear, parabolic and so on). Hence, sketch its graph, and indicate the direction of the path as *t* increases. |  |  |
|  | The top of a 10-m diving board lies over the swimming pool as illustrated below.  SM Test A fig 9-01  Sally sits 30 m away in the corner of the swimming pool and takes a bearing of 40° (N40°E) of the feet of her friend who is about to do a belly flop. State the position vector from Sally’s current position to her friend’s feet. |  |  |
|  | A river flows east–west at 5 m/s. A tugboat can motor at 3 m/s, and the captain tries to motor directly across the river from south to north.   1. Draw a vector diagram. 2. Calculate the resultant speed of the tugboat. 3. Calculate the bearing of the tugboat. 4. If it took 2 minutes to reach the opposite bank, how wide is the river? 5. In 2 minutes, how far downstream would the tugboat be carried? |  |  |