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| **MATHEMATICS DEPARTMENT**  **Year 11 Specialist – 2016**  **Test Number 1: Basic Vectors**  **Resource Free Section** |

**Whole test:**

**/ 47**

**Weight: 3.5%**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher: DDA**

**Marks: 31**

**Time Allowed: 30 minutes**

**Instructions:** You **ARE** **NOT** permitted any notes or calculator. Show your working where appropriate remembering you must show working for questions worth more than 2 marks.

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**1** Which of the following best describes the direction of the position vector of Q(–3, 7)?

**A**  113°

**B**  –113°

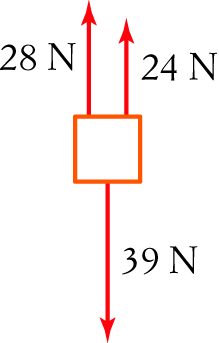
**C**  203°

**D**  67°

**E**   337°

[1 mark]

**2** Calculate the resultant of the forces shown below.



**A**   39 N down

**B**   91 N

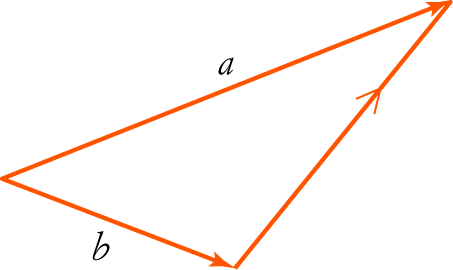
**C**  52 N up

**D**  13 N up

**E**  13 N down

[1 mark]

**3** This diagram shows vectors a, b and a third vector. Which of the following best describes the third vector?



**A**   a + b

**B**  a + –b

**C**  b + a

**D**  b – a

[1 mark]

**4** If m = i – 6j, which of the following vectors is opposite in direction to m?

**A**  –6i + j

**B**  (–2, –12)

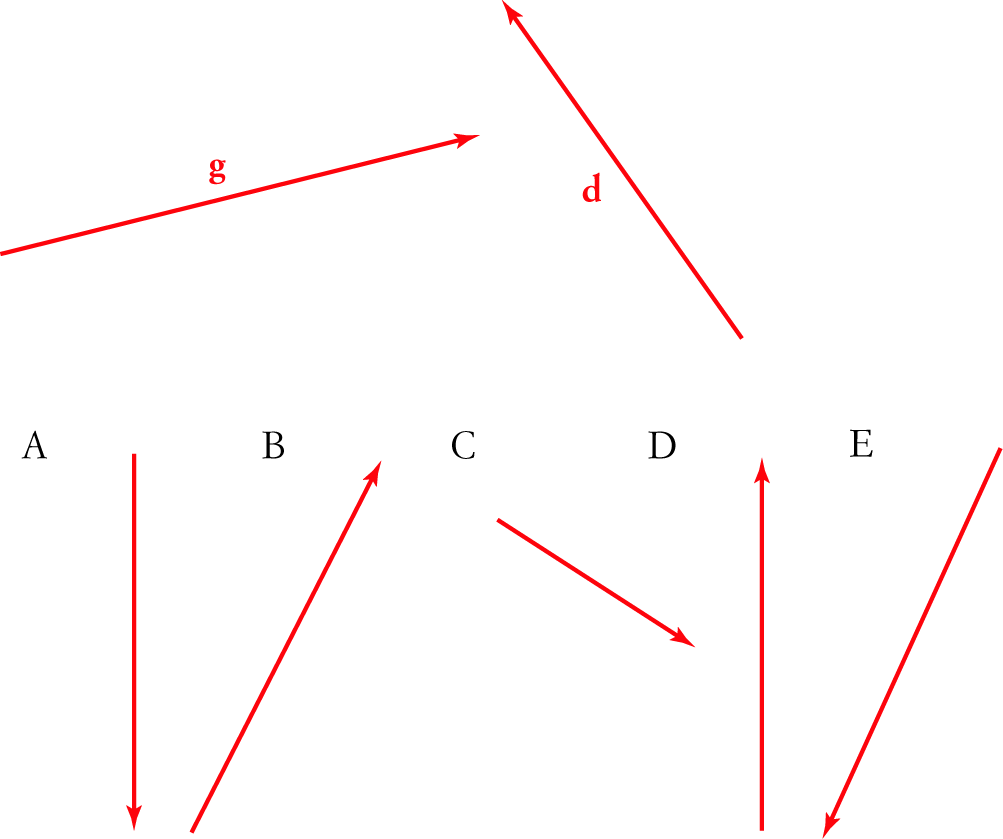
**C**  (–2, 12)

**D**  

**E**   6i – j

[1 mark]

**5** This diagram shows vectors g and d. Which of the following best represents the resultant of g and d?



[1 mark]

**6** Which of the following is orthogonal with (perpendicular to) n = (1, –1)?

**A**   2i + 2j

**B**  (2, –1)

**C**  –5i + 2j

**D**   (–2, 2)

**E**  (–4, 3)

[1 mark]

**7** Write the following vectors in polar form.

**a**   A vector a of magnitude 5 in the positive direction of the *y*-axis \_\_\_\_\_\_\_\_\_\_\_

**b**  A vector b with norm 7 in the negative direction of the *x*-axis \_\_\_\_\_\_\_\_\_\_\_

**c**   A vector c of magnitude 10 in a direction 135° anti-clockwise from the *x*-axis \_\_\_\_\_\_\_\_\_\_\_

[3 marks]

**8** Convert the vector  to polar form. \_\_\_\_\_\_\_\_\_\_\_\_

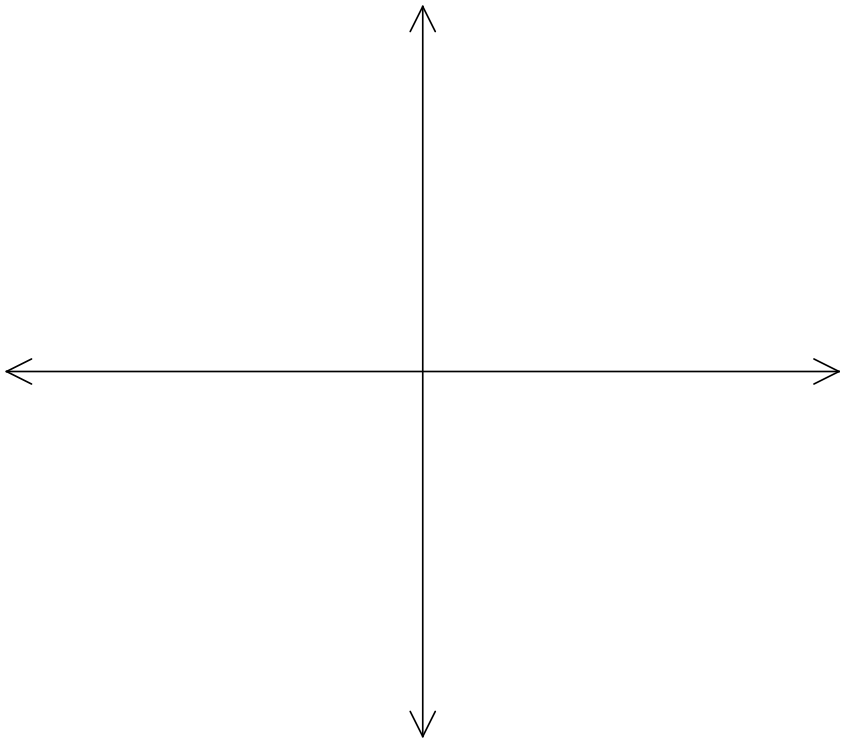
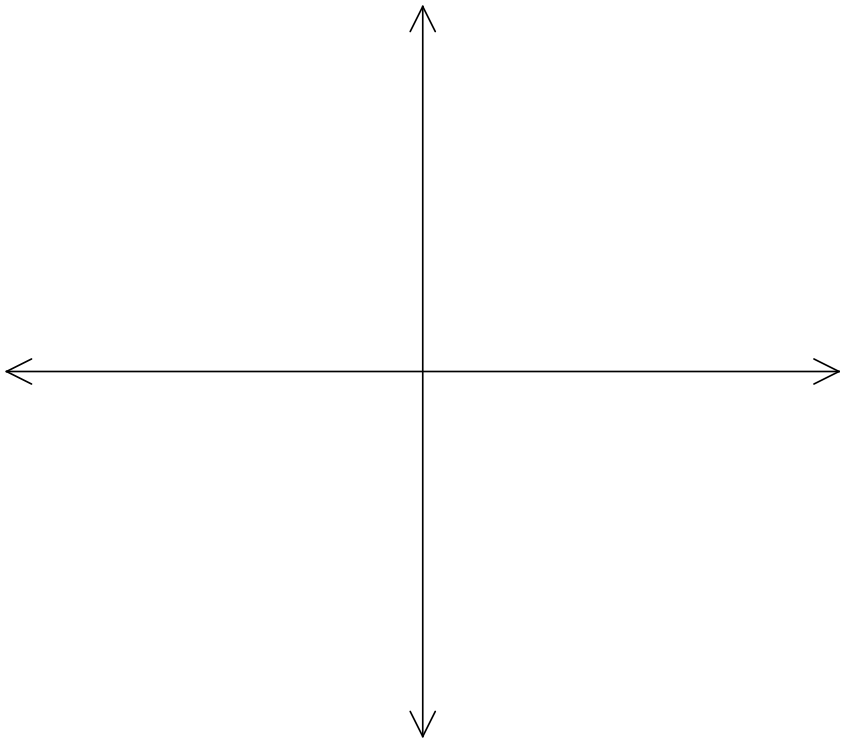
[1 mark]

**9** Find the norm of the vector (7, –24). \_\_\_\_\_\_\_\_\_\_\_\_

[1 mark]

**10** Sketch each of the following vectors. (Clearly label all relevant parts of your sketch.)

**a**   (–6, 9) **b**  (3, 300°)

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[2 marks]

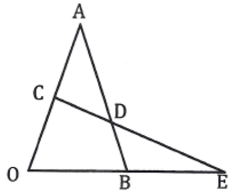
**11** Given b = (2, 7), d = (8, –2) and e = (–4, –2), find:

**a**   5e \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**b**    6d – 4b

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[2 marks]

**12** OAB is a triangle with C the mid-point of OA and D

a point of AB such that AD is two thirds of AB.

CD continued meets OB continued at E.

If and express each of the following in terms of and/or .

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. If and use the fact that to determine and .

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

**13** Write  as a linear combination of i and j. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[1 mark]

**14** Find the displacement vector for the following movement.

Q(–2, –5) to P(–5, 4)

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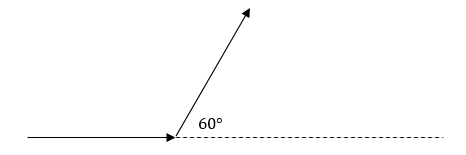
[1 mark]

**15** Using the component form of geometric vectors, complete the following proof for the associative law of vector addition.

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| --- |
| Let |
| RTP: |
| Proof: LHS = |
| = |
| = |
| = |
| = |
| = RHS |

[3 marks]

**16** Without changing her speed, a speed skater travelling at 27 m/s changes direction by 60°. What is her change in velocity?



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[3 marks]



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| **MATHEMATICS DEPARTMENT**  **Year 11 Specialist – 2016**  **Test Number 1: Basic Vectors**  **Resource Rich Section** |

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Marks: 16**

**Time Allowed: 15 minutes**

**Instructions:** You **ARE** allowed 1 page of notes (both sides) and a CAS calculator.  
  
***You must show your working to receive full marks whenever a question is worth more than 2 marks. Where relevant, and unless otherwise, specified give answers to 2 decimal places.***

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**17**  Convert the vector  (17.5, 161°) to component form.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[1 mark]

**18** Convert the vector (5,1) to polar form.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[1 mark]

**19**  Find the norm of the vector .

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1 mark]

**20**  Write (16, 217°) as a linear combination of i and j.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[1 mark]

**21** Given y = (22, 342°) and z = (15, 72°) , find y + z without changing to component form.

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[4 marks]

**22** Given g = (18, 144°) and m = (30, 225°), find g – m. Give your answer in polar form.

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[2 marks]

**23** A boat travels 19 nautical miles in a direction N 30° E and then travels 25 nautical miles south-east.   
Express each of these displacements in component form (east and north) and hence find the displacement for the whole journey in polar form. Give positive polar angle.

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[6 marks]