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| EGC_Black | **MATHEMATICS:SPECIALIST 1 & 2**  **SEMESTER 1 2015**  **TEST 3**  **Resource Free** |

Time Allowed: 24 minutes Total Marks: 19

**1.** [1, 3 marks]

A

B

C

D

A line drawn from a point A forms a tangent to a circle at B. A second line from A cuts through the same circle at point C and D.

(a) State a relationship between the lengths of the line segments AB, AD and AC.

(b) Hence prove that ΔABD ~ ΔACB.

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

Given vectors **m** = 5**i** – 2**j** and **n** = 4**i** + 3**j**, determine

(a) the scalar projection of **m** onto **n**.

(b) the vector projection of **m** onto **n**.

**3.** [6 marks]

O

A

B

C

M

Prove that the diagonals of a parallelogram bisect each other.

OABC is a parallelogram with = **a** and = **c**. The diagonals OB and AC meet at M.

If = h and = k, use the fact that to show that h = k = ½.

**4.** [1, 1, 3 marks]

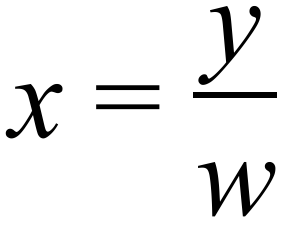
(a) Find a counter-example to show that the following conjecture is not true.

and then

(b) Find an example to show that the following conjecture is true.

such that

(c) Write the mathematical notation for the statement:

*For all rational numbers x, there exist integers y and w such that  where w is non-zero.*

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| EGC_Black | **MATHEMATICS:SPECIALIST 1 & 2**  **SEMESTER 1 2015**  **TEST 3**  **Calculator Assumed** |

Time Allowed: 27 minutes Total Marks: 22

**5.** [2 marks]

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 .

A force acting on a bearing of 160º does work of 1 200 joules. If the object moved a distance of 350 cm on a bearing of 135º, determine the magnitude of the force. (2 marks)

**6.** [2, 4 marks]

B

O

140°

A

C

D

*b*

*d*

(a) A circle centred at O has s∠AOC = 140°, as shown in the diagram. Determine the values of *b* and *d*. Justify your answers.

55°

S

T

O

x°

A

B

C

D

(b) A circle centred at O has a tangent ST as shown in the diagram. Given that s∠CDT = 55°, determine the value of x. Justify your answer.

**7.** [5 marks]

O

A

B

C

**a**

**b**

Prove that if the diagonals of a rectangle are perpendicular then the rectangle is a square.

O

A

B

C

X

Y

**b**

**a**

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

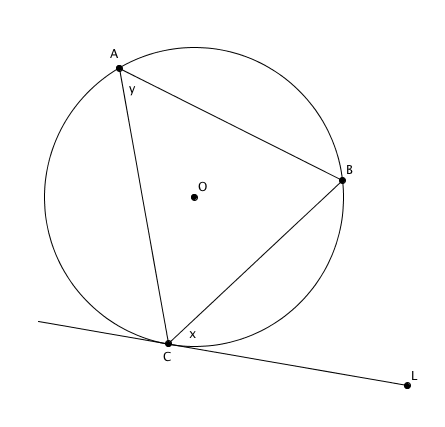
OABC is a parallelogram, X is the midpoint of AB and Y is such that = .

Let = **a** and = **b**.

(a) Express and in terms of **a** and/or **b**.

(b) Show that • = **a**•**b** + 8, given ⎪**a**⎪ = 3 and ⎪**b**⎪ = 2.

9. [4 marks]

In the diagram, CL is a tangent to a circle with centre O at C.

Angle BCL = *x*  and

Angle CAB = *y.*

Prove that *x* = *y*