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## MATHEMATICAL METHODS VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2016

### TEST 1: ALGEBRA AND POLYNOMIALS

TOTAL 30 MARKS (45 MINUTES)

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Student's Name: \_\_\_\_\_ Teacher's Name: \_\_\_\_\_

#### Directions to students

Write your name and your teacher's name in the spaces provided above.  
Answer all questions in the spaces provided.

#### SECTION A: SHORT-ANSWER QUESTIONS (TECHNOLOGY-FREE)

##### Instructions for Section A

Answer **all** questions in the spaces provided.

In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.

In questions where more than one mark is available, appropriate working **must** be shown.

Unless otherwise indicated, the diagrams in this test are **not** drawn to scale.

#### Question 1 (1 mark)

Solve  $\sqrt{(x+p)^3} = q$  for  $x$ , where  $p$  and  $q$  are positive real numbers.

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**SECTION B: MULTIPLE-CHOICE QUESTIONS (TECHNOLOGY-ACTIVE)**

**Instructions for Section B**

For each question in Section B, choose the response that is correct and circle your choice.

Choose the response that is **correct** or **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

**Question 1**

The number of distinct real solutions to the equation  $(k - 2x)(x^3 + 4kx)(x + k)^2(x^2 - k^2) = 0$  where  $k \in \mathbb{R}^+$  is

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

**Question 2**

Which one of the following is a straight line perpendicular to the straight line with equation  $ax - by = 10$  where  $a, b > 1$ ?

- A.  $ax + by = 5$
- B.  $bx - ay = 10$
- C.  $ay - bx = 5$
- D.  $bx + ay = 10$
- E.  $ax - by = 5$

**Question 3**

If a polynomial  $P(x)$  is divisible by  $2x + 1$ , then the polynomial  $Q(x) = \frac{P(2-x)}{3}$  is divisible by

- A.  $2x - 5$
- B.  $5x - 2$
- C.  $x - 3$
- D.  $2x + 3$
- E.  $2x - 3$

**Question 4**

The solution to the equation  $(x^2 - 5x + 5)^{x^2 - 9x + 20} = 1$  is given by the set

- A.  $\{1, 5\}$
- B.  $\{4, 5\}$
- C.  $\{1, 4\}$
- D.  $\{1, 4, 5\}$
- E.  $\{1, 2, 3, 4, 5\}$

**SECTION C: EXTENDED-ANSWER QUESTIONS (TECHNOLOGY-ACTIVE)**

**Instructions for Section C**

Answer **all** questions in the spaces provided.

In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.

In questions where more than one mark is available, appropriate working **must** be shown.

Unless otherwise indicated, the diagrams in this test are **not** drawn to scale.

**Question 1** (14 marks)

Let  $P(x) = x^2(2x - 1)$ .

- a. Find the remainder when  $P(x)$  is divided by  $x + 2$ . 1 mark

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- b. Let  $Q(x) = x^3 + x^2 + mx - 6$ ,  $m \in R$ .

- i. Find the value of  $m$  if  $Q(1) = P(1)$ . 2 marks

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- ii. Find the values of  $x$  for which the curve with equation  $y = p(x)$  intersects the curve with equation  $y = q(x)$ . 2 marks

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## MATHEMATICAL METHODS VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2016

### TEST 1: ALGEBRA AND POLYNOMIALS

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#### SUGGESTED SOLUTIONS AND MARKING SCHEME

#### SECTION A: SHORT-ANSWER QUESTIONS (TECHNOLOGY-FREE)

**Question 1** (1 mark)

$$\sqrt{(x+p)^3} = q$$

$$(x+p)^3 = q^2$$

$$x+p = q^{\frac{2}{3}}$$

$$x = q^{\frac{2}{3}} - p$$

A1

**SECTION B: MULTIPLE-CHOICE QUESTIONS (TECHNOLOGY-ACTIVE)**

**Question 1      B**

$$(k - 2x)(x^3 + 4kx)(x + k)^2(x^2 - k^2) = 0$$

$$(k - 2x) = 0$$

$$x = \frac{k}{2}$$

$$(x^3 + 4kx) = 0$$

$$x(x^2 + 4k) = 0$$

$$x = 0$$

$$(x + k)^2 = 0$$

$$x = -k$$

$$(x^2 - k^2) = 0$$

$$(x - k)(x + k) = 0$$

$$x = \pm k$$

There are 4 distinct solutions.

*Multiple-choice explanations:*

Option **A** overlooks the solution  $x = 0$ .

Option **C** counts the solution  $x = k$  twice.

Option **D** finds two solutions to  $x^2 = -4k$ , which has no solutions since  $k > 0$ .

Option **E** counts repeated solutions and finds two solutions to  $x^2 = -4k$ , which has no solutions since  $k > 0$ .

**Question 2      D**

$$ax - by = 10$$

$$by = ax - 10$$

$$y = \frac{a}{b}x - \frac{10}{b}$$

This line has gradient  $\frac{a}{b}$ .

A line perpendicular to this has gradient  $-\frac{b}{a}$ .

$$bx + ay = 5$$

$$y = -\frac{b}{a}x + \frac{5}{a}$$

*Multiple-choice explanations:*

Option **A** has gradient  $-\frac{a}{b}$ .

Option **B** has gradient  $\frac{b}{a}$ .

Option **C** has gradient  $\frac{b}{a}$ .

Option **E** is parallel to the given line.