



**SPECIALIST MATHEMATICS VCE UNITS 3&4
DIAGNOSTIC TOPIC TESTS 2016**

TEST 1: FUNCTIONS, GRAPHS AND TRIGONOMETRY

TOTAL 30 MARKS (45 MINUTES)

Student's Name: _____ Teacher's Name: _____

Directions to students

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

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

Instructions for Section A
Answer **all** questions in the spaces provided.

Question 1 (2 marks)

Given that $\tan(2x) = \frac{1}{2}$, find the possible values of $\tan(x)$.

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

Instructions for Section B

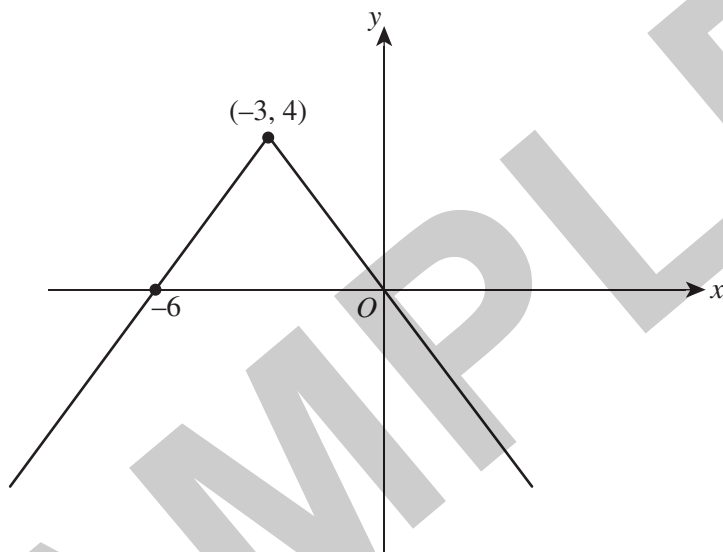
For each question in Section B, choose the response that is **correct** and circle your choice.

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 equation of the function whose graph is shown above is

- A. $y = -\frac{4}{3}|x| + 4$
- B. $y = \frac{3}{4}|x + 4| + 3$
- C. $y = \frac{3}{4}|x + 3| + 4$
- D. $y = -\frac{4}{3}|3 - x| + 4$
- E. $y = -\frac{4}{3}|x + 3| + 4$

SECTION C: EXTENDED-ANSWER QUESTIONS (TECHONLOGY-ACTIVE)

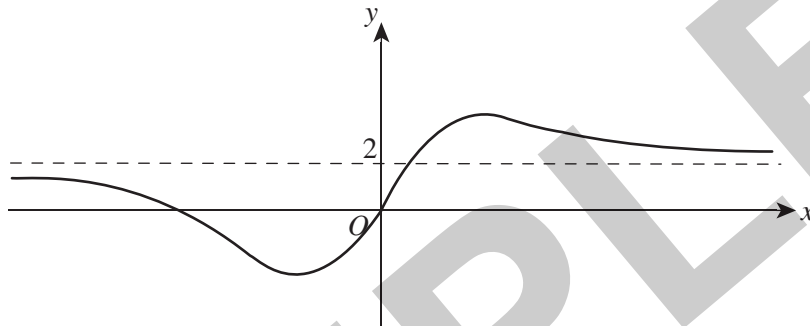
Instructions for Section C

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

Question 1 (14 marks)

The function f is defined as $f(x) = \frac{ax^2 + bx}{2x^2 - c}$ where a , b and c are non-zero constants.

The graph of $y = f(x)$ is shown below. The line $y = 2$ is a horizontal asymptote.



a. i. Show that $a = 4$.

3 marks

ii. Show that $c < 0$.

3 marks

SPECIALIST MATHEMATICS VCE UNITS 3&4 DIAGNOSTIC TOPIC TESTS 2016

TEST 1: FUNCTIONS, GRAPHS AND TRIGONOMETRY

SUGGESTED SOLUTIONS AND MARKING SCHEME

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

Question 1 (2 marks)

Use of $\tan(2x) = \frac{2 \tan(x)}{1 - \tan^2(x)}$ to obtain $\frac{2 \tan(x)}{1 - \tan^2(x)} = \frac{1}{2}$.

$$\tan^2(x) + 4 \tan(x) - 1 = 0$$

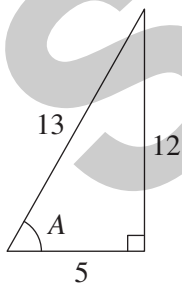
$$\therefore \tan(x) = -2 \pm \sqrt{5}$$

M1

A1

Question 2 (4 marks)

a. $\sin(A) = \frac{12}{13}$



$$\cos(A) = \frac{5}{13}$$

A1

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

Question 1 E

The equation of the graph has the form $y = a|x + 3| + 4$.

Given that the graph passes through the origin, $a = -\frac{4}{3}$.

Multiple-choice explanations:

Option **A** does not apply a horizontal translation.

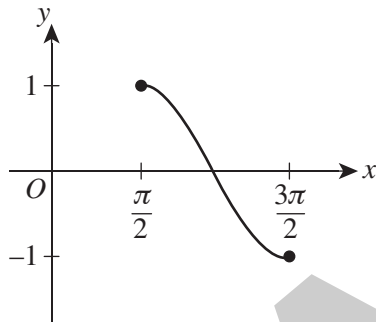
Option **B** has an incorrect dilation factor (a -value) and an incorrect sharp point $(-4, 3)$.

Option **C** has an incorrect dilation factor (a -value) and a correct sharp point $(-3, 4)$.

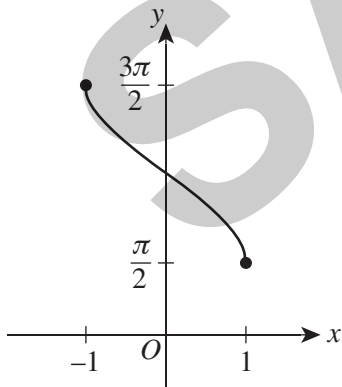
Option **D** has an incorrect sharp point $(3, 4)$.

Question 2 C

The graph of f is



The graph of f^{-1} is a reflection of the graph of f in the line $y = x$.



Multiple-choice explanations:

Option **A** is the graph of $y = \sin^{-1}(x)$, $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$.

Option **B** is the graph of f .

Option **D** is the reflection of the correct graph in the y -axis.

Option **E** has correct endpoints, but an incorrect shape.