

## PAST CLASS TESTS

In the years up to 2007 there were 3 calculus class tests per session. From semester 1 2008 there will be only 2 calculus class tests per semester so the pre-2008 tests included here do not have the same coverage of material as the class tests for 2008 and onwards. The Information booklet for MATH1131/1141 lists the material available for examination in the current schedule of class tests. Also there have been some changes to the syllabus for 2008 and onwards and some parts of the questions in the following pre-2008 class tests are no longer examinable. Thus the following pre-2008 tests should only be taken as a guide to the level of difficulty to be expected in class test questions for 2008 and onwards.

Sample class tests from 2008 and onwards are included after all the pre-2008 class tests and these tests correspond to the current syllabus and class test schedule. However, the content of the class tests is specified in the Information booklet for MATH1131/1141.

The following selection of past class tests can be used as a guide to the degree of difficulty of calculus class tests. Due to variations in the timing of the mid-semester breaks the material examined in each class test can vary from semester to semester and from year to year.

UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S1 2008  
TEST 1 VERSION 5a

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Student's Family Name

Initials

Student Number

Tutorial Code

Tutor's Name

Mark

**Note: The use of a calculator is NOT permitted in this test**

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*2 marks*)

Solve  $|2 - 3x| \leq 1$ .

2. (*2 marks*)

Find the (maximal) domain and the range of the function  $f(x) = \frac{1}{\sqrt{3-x}}$ .

3. (*2 marks*)

Sketch the graph  $y = x^2 - 3x - 10$ , and hence sketch the graph  $y = \frac{1}{x^2 - 3x - 10}$ .

4. (*2 marks*)

For  $f(x) = \frac{|x^2 - 9|}{x - 3}$  and  $a = 3$ , discuss the limiting behaviour of  $f(x)$  as  $x \rightarrow a^+$ , as  $x \rightarrow a^-$  and as  $x \rightarrow a$ .

5. (*2 marks*)

Determine the limiting behaviour of  $f(x) = \frac{2x + 3x^2 + e^{-x}}{2x^2 + \cos x}$  as  $x \rightarrow \infty$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S2 2008  
TEST 1 VERSION 2b

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Student's Family Name

Initials

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Student Number

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Tutorial Code

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Tutor's Name

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Mark

**Note:** The use of a calculator is NOT permitted in this test

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (2 marks)

Let  $f(x) = x^2 + 4$ , and  $g(x) = \frac{1}{\sqrt{x+1}}$ . Give the explicit forms of  $(f \circ g)(x)$  and  $(g \circ f)(x)$ .

2. (2 marks)

Find the limiting value of  $f(x) = \frac{x^2 - 5x + 6}{2x^2 - 5x + 2}$  as  $x$  tends to 2.

3. (2 marks)

For  $f(x) = \frac{|x^2 - 4x + 3|}{x - 1}$  and  $a = 1$ , discuss the limiting behaviour of  $f(x)$  as  $x \rightarrow a^+$ , as  $x \rightarrow a^-$  and as  $x \rightarrow a$ .

4. (2 marks)

Solve  $|2 - 3x| \leq 1$ .

5. (2 marks)

Find the (maximal) domain and the range of the function  $f(x) = \ln(x^2 - 5)$ .

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SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131/1141 Calculus S1 2009  
TEST 1 VERSION 8a

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Student's Family Name

Initials

Student Number

Tutorial Code

Tutor's Name

Mark

**Note: The use of a calculator is NOT permitted in this test**

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*2 marks*)

Sketch the graph  $y = \sqrt{x+2}$ , and hence sketch the graph  $y = \frac{1}{\sqrt{x+2}}$ .

2. (*2 marks*)

Solve  $|3x+2| \geq 1$ .

3. (*2 marks*)

Find the (maximal) domain and range of the function  $f(x) = \frac{1}{\sqrt{9-x^2}}$ .

4. (*2 marks*)

Determine the limiting behaviour of  $f(x) = \frac{e^{-x} + 3x^2 - 2}{4x^2 + 3x + \sin x}$  as  $x \rightarrow \infty$ .

5. (*2 marks*)

For  $f(x) = \frac{x-2}{|x^2-4|}$  and  $a=2$ , discuss the limiting behaviour of  $f(x)$  as  $x \rightarrow a^+$ , as  $x \rightarrow a^-$  and as  $x \rightarrow a$ .

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SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S1 2009  
TEST 1 VERSION 6a

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Student's Family Name

Initials

Student Number

Tutorial Code

Tutor's Name

Mark

**Note:** The use of a calculator is NOT permitted in this test

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (2 marks)

Solve  $\frac{1}{x+1} \leq -\frac{1}{2}$ .

2. (2 marks)

Find the (maximal) domain and the range of the function  $f(x) = \sqrt{2 - e^{-x}}$ .

3. (2 marks)

Let  $f(x) = 3x + 4$ , and  $g(x) = \frac{1}{\sqrt{x-2}}$ . Give the explicit forms of  $(f \circ g)(x)$  and  $(g \circ f)(x)$ .

4. (2 marks)

Find the limiting value of  $f(x) = \frac{2x^2 - x - 6}{3x^2 - 2x - 8}$  as  $x$  tends to 2.

5. (2 marks)

For  $f(x) = \frac{|x^2 + 3x - 18|}{x - 3}$  and  $a = 3$ , discuss the limiting behaviour of  $f(x)$  as  $x \rightarrow a^+$ , as  $x \rightarrow a^-$  and as  $x \rightarrow a$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S2 2009  
TEST 1 VERSION 1a

This sheet must be filled in and stapled to the front of your answers

Student's Family Name

Initials

Student Number

Tutorial Code

Tutor's Name

Mark

**Note: The use of a calculator is NOT permitted in this test**

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*2 marks*)

Sketch the set of points in the  $(x, y)$  plane satisfying  $0 < x < 3y$  and  $0 < y < 2$ .

2. (*2 marks*)

Solve  $\left| \frac{3x+1}{2} \right| \leq 2$ .

3. (*2 marks*)

Find the (maximal) domain and the range of the function  $f(x) = \frac{1}{\sqrt{x-1}}$ .

4. (*2 marks*)

For  $f(x) = \frac{|x^2 - 4x + 3|}{3 - x}$  and  $a = 3$ , discuss the limiting behaviour of  $f(x)$  as  $x \rightarrow a^+$ , as  $x \rightarrow a^-$  and as  $x \rightarrow a$ .

5. (*2 marks*)

Consider the function

$$f(x) = -\cos x$$

on the interval  $(-\pi/2, \pi/2)$ . Determine whether  $f$  attains a maximum value on the interval. Give reasons for your answer.

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SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131/MATH1141 Calculus S1 2010  
TEST 1 VERSION 7b

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Student's Family Name

Initials

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Student Number

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Tutorial Code

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Tutor's Name

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Mark

**Note:** The use of a calculator is NOT permitted in this test

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (2 marks)

Sketch the graph  $y = \sqrt{x-1}$ , and hence sketch the graph  $y = \frac{1}{\sqrt{x-1}}$ .

2. (2 marks)

For  $f(x) = \frac{|x^2 + x - 2|}{x - 1}$  and  $a = 1$ , discuss the limiting behaviour of  $f(x)$  as  $x \rightarrow a^+$ , as  $x \rightarrow a^-$  and as  $x \rightarrow a$ .

3. (2 marks)

Let  $p(x) = x^3 - 3x^2 - 4x + 2$ . Use the Intermediate Value Theorem to show that  $p$  has a root between  $-2$  and  $0$ .

4. (2 marks)

Solve  $\frac{1}{x+1} > -\frac{1}{2}$ .

5. (2 marks)

Find the (maximal) domain and the range of the function  $f(x) = \sqrt{3+x}$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S1 2008  
TEST 2 VERSION 8a

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Student's Family Name

Initials

Student Number

Tutorial Code

Tutor's Name

Mark

**Note: The use of a calculator is NOT permitted in this test**

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (2 marks)

Show that the function  $f$  given by  $f(x) = x^3 - 2x^2 - 3x + 3$  has a zero in each of the intervals  $[0, 1]$  and  $[2, 3]$ .

2. (2 marks)

Using the definition of the derivative, show that if  $f(x) = -2x^2 + x$  then  $f'(x) = -4x + 1$ .

3. (2 marks)

The length  $L$  of a rectangle is decreasing at the rate of 2 cm per second, and the width  $W$  is increasing at the rate of 4 cm per second. Find the rate of change of the area when  $L=13$  cm and  $W=10$  cm.

4. (2 marks)

State the Mean Value Theorem. Find a point which satisfies the conclusions of the Mean Value Theorem for  $f(x) = x^3 - 2x^2 + 5$  on the interval  $[0, 2]$ .

5. (2 marks)

Find  $\lim_{x \rightarrow 0} \frac{x \sin x}{1 - \cos x}$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S2 2008  
TEST 2 VERSION 4b

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Student's Family Name

Initials

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Student Number

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Tutorial Code

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Tutor's Name

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Mark

**Note:** The use of a calculator is NOT permitted in this test

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (2 marks)

State the Mean Value Theorem and find a point which satisfies the conclusions of the Mean Value Theorem for  $f(x) = \sqrt{x-1}$  on the interval  $[1, 3]$ .

2. (2 marks)

Find  $\lim_{x \rightarrow 0} \frac{1 - \cos 3x}{x^2}$ .

3. (2 marks)

Show that the function  $f$  given by  $f(x) = x^3 - 3x^2 - 2x + 5$  has a zero in each of the intervals  $[-2, -1]$  and  $[1, 2]$ .

4. (2 marks)

Using the definition of the derivative, show that if  $f(x) = -x^3$  then  $f'(x) = -3x^2$ .

5. (2 marks)

Find the equation of the line tangent to  $x^2 + y^3 - x^2y = 1$  at  $(1, 1)$ .

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UNIVERSITY OF NEW SOUTH WALES  
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MATH1131 Mathematics 1A Calculus S1 2009  
TEST 2 VERSION 8b

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Student's Family Name

Initials

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Tutorial Code

Tutor's Name

Mark

**Note: The use of a calculator is NOT permitted in this test**

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*2 marks*)

Carefully state the Mean Value Theorem. Find a point which satisfies the conclusions of the Mean Value Theorem for  $f(x) = x^3 - x^2 + 3$  on the interval  $[0, 1]$ .

2. (*2 marks*)

Find  $\lim_{x \rightarrow 1} \frac{3x^3 - 5x^2 + x + 1}{x^2 - 2x + 1}$ .

3. (*2 marks*)

Determine the values of  $x$  at which the function

$$f(x) = \begin{cases} x^3 & \text{for } x < 1 \\ (x-1)^3 + 2 & \text{for } x \geq 1 \end{cases}$$

is continuous. Give reasons for your answer.

4. (*2 marks*)

Using the definition of the derivative, show that if  $f(x) = -x^3$  then  $f'(x) = -3x^2$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131/1141 Calculus S1 2009  
TEST 2 VERSION 1a

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Tutorial Code

Tutor's Name

Mark

**Note:** The use of a calculator is NOT permitted in this test

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*2 marks*)

The function

$$f(x) = \frac{x-2}{x^2-3x+2}$$

is not defined for  $x = 2$ . Find a value to be given to  $f(2)$  that will make  $f$  continuous at 2.

2. (*3 marks*)

Determine all real values of  $a$  and  $b$  such that the function

$$f(x) = \begin{cases} ax + b & \text{for } x \leq 1 \\ \tan \frac{\pi x}{4} & \text{for } 1 < x < 2 \end{cases}$$

is differentiable at  $x = 1$ .

3. (*3 marks*)

Let  $f(x) = |x^2 - 2x|$ .

- (i) Giving reasons for your answer, find all critical points of  $f$  on the interval  $[0, 5]$ .
- (ii) Find the absolute maximum and absolute minimum values of  $f(x)$  on the given interval.

4. (*2 marks*)

Find  $\lim_{x \rightarrow 1} \frac{2x^4 - 3x^3 + x}{(x-1)^2}$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131 Mathematics 1A Calculus S2 2009  
TEST 2 VERSION 3a

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Student's Family Name

Initials

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Student Number

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Tutorial Code

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Tutor's Name

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Mark

**Note: The use of a calculator is NOT permitted in this test**

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*2 marks*)

Find the equation of the line tangent to  $x + \ln x = y + 2 \ln y$  at  $(1, 1)$ .

2. (*2 marks*)

A ladder of length 3 metres is leaning against a vertical wall. The foot of the ladder is pulled away from the wall at the rate of 0.5 metres per second. How fast is the top of the ladder moving down the wall when the foot is 1 metre away from the wall? (Leave your answer in surds.)

3. (*2 marks*)

Carefully state the Mean Value Theorem and find a point which satisfies the conclusions of the Mean Value Theorem for  $f(x) = \sqrt{x-1}$  on the interval  $[1, 3]$ .

4. (*3 marks*)

Let  $f(x) = (x-1)^{2/3}$ .

- (i) Giving reasons for your answer, find all critical points of  $f$  on the interval  $[0, 2]$ .
- (ii) Find the absolute maximum and absolute minimum values of  $f(x)$  on the given interval.

5. (*1 mark*)

Find  $\lim_{x \rightarrow 0} \frac{\tan x}{x}$ .

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UNIVERSITY OF NEW SOUTH WALES  
SCHOOL OF MATHEMATICS AND STATISTICS  
MATH1131/MATH1141 Calculus S1 2010  
TEST 1 VERSION 2a

This sheet must be filled in and stapled to the front of your answers

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Student's Family Name

Initials

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Student Number

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Tutorial Code

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Tutor's Name

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Mark

**Note:** The use of a calculator is NOT permitted in this test

**QUESTIONS** (*Time allowed: 20 minutes*)

1. (*3 marks*)

Determine all real values of  $a$  and  $b$  such that the function

$$f(x) = \begin{cases} ae^x + b & \text{for } x < 0, \\ \sin x & \text{for } x \geq 0 \end{cases}$$

is differentiable at  $x = 0$ .

2. (*1 mark*)

Find  $\lim_{x \rightarrow 0} \frac{\tan x}{e^{3x} - 1}$ .

3. (*2 marks*)

Find the equation of the line tangent to  $x^3 + y^3 - x - y^2 = 0$  at  $(1, 1)$ .

4. (*3 marks*)

Determine how many real numbers satisfy the equation  $x^3 - 6x^2 + 1 = 0$ . Give reasons for your answer, naming any theorems you use. (Hint: find the stationary points of the polynomial function.)

5. (*1 mark*)

Differentiate  $\tan^{-1}(4x + 1)$ .

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