

**DSC1520**

(458793)

May/June 2010

QUANTITATIVE MODELLING I

Duration 2 Hours

100 Marks

EXAMINERS :

FIRST :

MRS MF IMMELMAN

SECOND

PROF PH POTGIETER

Programmable pocket calculator is permissible.

This examination paper remains the property of the University of South Africa and may not be removed from the examination venue.

This examination question paper consists of 19 pages, including 4 pages for rough work. The paper comprises 25 questions that count a total of 100 marks.

THE USE OF A PROGRAMMABLE CALCULATOR IS PERMITTED.

The paper is divided into two parts: Section A and Section B.

SECTION A**[60]**

Answer ALL the questions in this section on the mark-reading sheet supplied. Follow the instructions for completing the mark-reading sheet carefully.

Also pay attention to the following information. Suppose you are asked the question:

$$3 + 2 \times -1 + 4 \div 2 =$$

- [1] 7
- [2] 1
- [3] 3
- [4] 4
- [5] None of the above

The correct answer is [3]. Only one option (indicated as [1] [2] [3] [4] [5]) per question is correct. If you mark more than one option, you will get no marks for that question. For a correct answer you will receive 3 MARKS. Marks WILL NOT be deducted for incorrect answers.

Section A consists of 20 questions and counts 60 marks. Hand in the completed mark-reading sheet with your answers for Section B. DO NOT STAPLE IT!

[TURN OVER]

SECTION B

This section must be completed in the space provided below each question. Section B consists of 5 questions and counts 40 marks.

Remember to include your MARK-READING SHEET IN YOUR ANSWER BOOK.

SECTION A**[60]****Question 1**

Simplify

$$\frac{2}{3} \div \frac{5}{6} + 5 - \frac{5}{4} - 1\frac{1}{3} \times 6$$

- [1] -3
- [2] $\frac{3}{10}$
- [3] $-\frac{19}{20}$
- [4] $-3\frac{1}{5}$
- [5] None of the above

Question 2

In 2010, a luxury motor car is valued at R634 000. This is 25% higher than the price paid for the car in 2007. What was the price paid in 2007?

- [1] R550 000
- [2] R507 000
- [3] R475 500
- [4] R158 500
- [5] None of the above

[TURN OVER]

Question 3

Evaluate the following definite integral

$$\int_{-1}^2 (-4x + 6) dx$$

- [1] -10
- [2] 6
- [3] 12
- [4] -6
- [5] None of the above

Question 4

Determine the value of x that solves the inequality

$$-3(x + 1) + 6\left(x + \frac{1}{3}\right) \leq 4\left(x - \frac{1}{2}\right)$$

- [1] $x \leq -\frac{3}{7}$
- [2] $x \leq -1$
- [3] $x \geq +1$
- [4] $x \geq -\frac{1}{2}$
- [5] None of the above

Question 5

The line $2y - 4x + 8 = 1$ has a slope of

- [1] 7
- [2] -4
- [3] 2
- [4] 4
- [5] none of the above.

Question 6

Find the equation of the straight line passing through the points (10; 5) and (5, 10)

- [1] $y = 5x - 10$
- [2] $y = x - 5$
- [3] $y = x$
- [4] $y = -x + 15$
- [5] None of the above

Question 7

If the demand function is

$$P = 250 - 5Q$$

where P and Q are the price and quantity respectively, determine the point price elasticity of demand if the price P equals 20

- [1] $\frac{250}{5}$
- [2] $\frac{20}{15}$
- [3] $\frac{20}{230}$
- [4] $\frac{5}{20}$
- [5] None of the above

Question 8

The coordinates of the intersection of the two lines

$$\begin{aligned}2x + 3y &= 5 \\20x - 9y &= 21\end{aligned}$$

are

- [1] (1, 1)
- [2] (1, 5, 1)
- [3] (2, 5, 0)
- [4] $(0, \frac{5}{3})$
- [5] none of the above

Question 9

The cost to produce a number x of a toy is $C = 2700 + 25x$ The selling price of a toy is R45 How many toys should be produced to break even?

- [1] 1350
- [2] 600
- [3] 135
- [4] 540
- [5] None of the above

Question 10

Solve the following system of linear equations

$$-x + 2y + 2z = 29$$

$$x - y + z = 0$$

$$2y - 2z = 2.$$

- [1] $x = 1; y = 9; z = 8$
- [2] $x = 1; y = 8,5; z = 7,5$
- [3] $x = 1; y = 8; z = 7$
- [4] $x = 1; y = 6; z = 5$
- [5] None of the above

Question 11

The coordinates of the turning point of the graph $y = 2x^2 - 5x - 3$ are

- [1] (1,25; 3)
- [2] (-1,25; -6,25)
- [3] (1,25; -3)
- [4] (1,25; -6,125)
- [5] none of the above

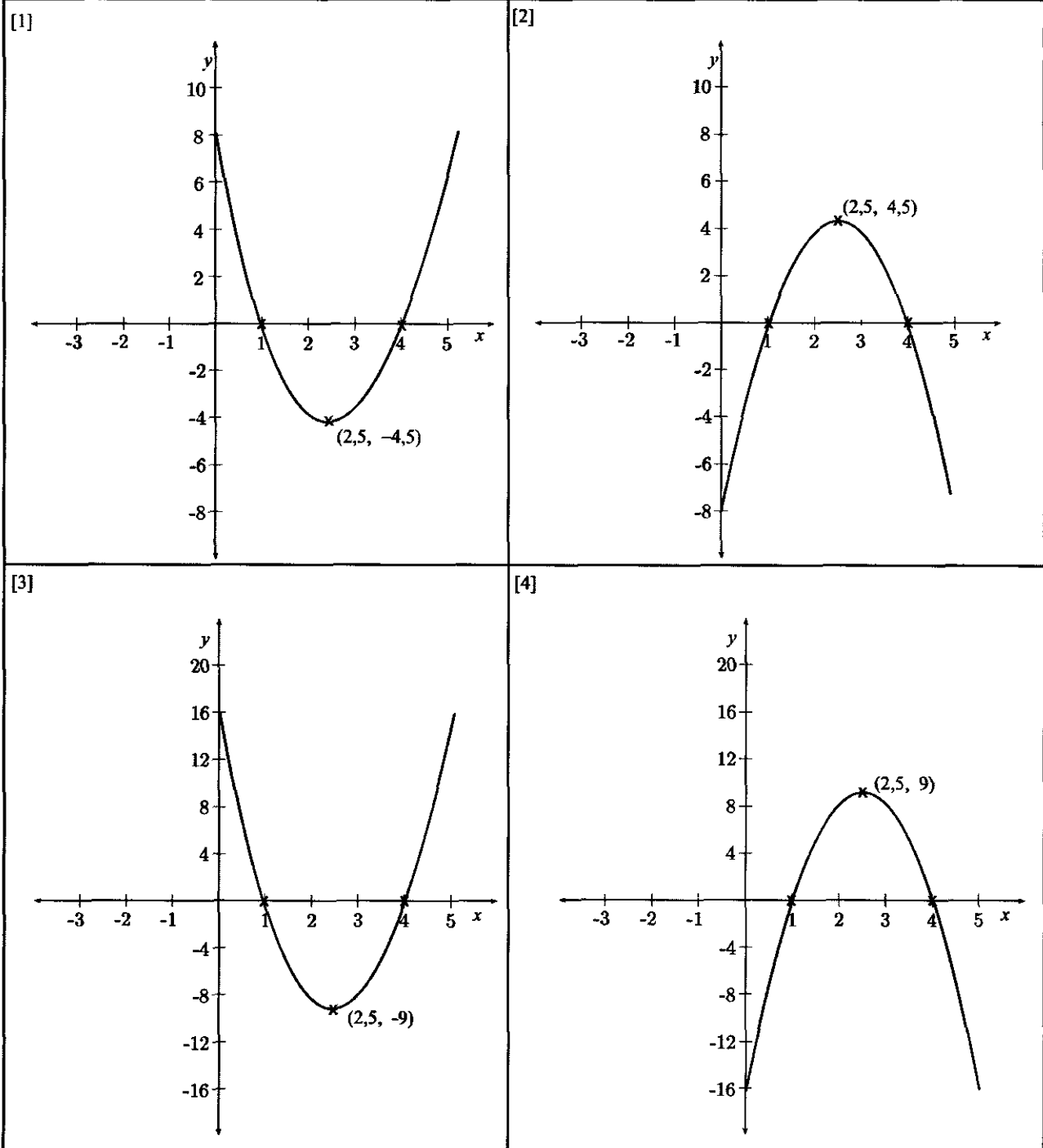
Question 12

Determine

$$\frac{\log_3 12,34}{\ln \sqrt{12,34}}$$

accurate to three decimal places.

- [1] 0,869
- [2] 0,910
- [3] 1,811
- [4] 1,965
- [5] None of the above

Question 13Which graph represents the function $2y = -4x^2 + 20x - 16$?

[5] None of the above

[TURN OVER]

Question 14

Simplify the following expression

$$\frac{(2a^3b^2)^2 \times (a^4b)^3}{(2a^2b^3)^4}$$

- [1] $64a^{26}b^{19}$
- [2] $\frac{a^6}{4}$
- [3] $\frac{a^{10}}{4b^5}$
- [4] $\frac{a^{10}}{b^5}$
- [5] None of the above

Question 15

The weekly growth of a mouse in a research laboratory takes place according to the formula

$$y = \frac{46,04}{1 + 13,720(0,596)^x}$$

where y is the average mass (in grams) and x the number of weeks since birth. What is the average mass of a mouse after 10 weeks?

- [1] 42,72g
- [2] 46,04g
- [3] 46,12g
- [4] 50,17g
- [5] None of the above

Question 16

Find the derivative of the function

$$f(x) = x^2 + 5x$$

- [1] $f'(x) = 2x$
- [2] $f'(x) = 5x + 2$
- [3] $f'(x) = 5$
- [4] $f'(x) = 2x + 5$
- [5] None of the above

Question 17

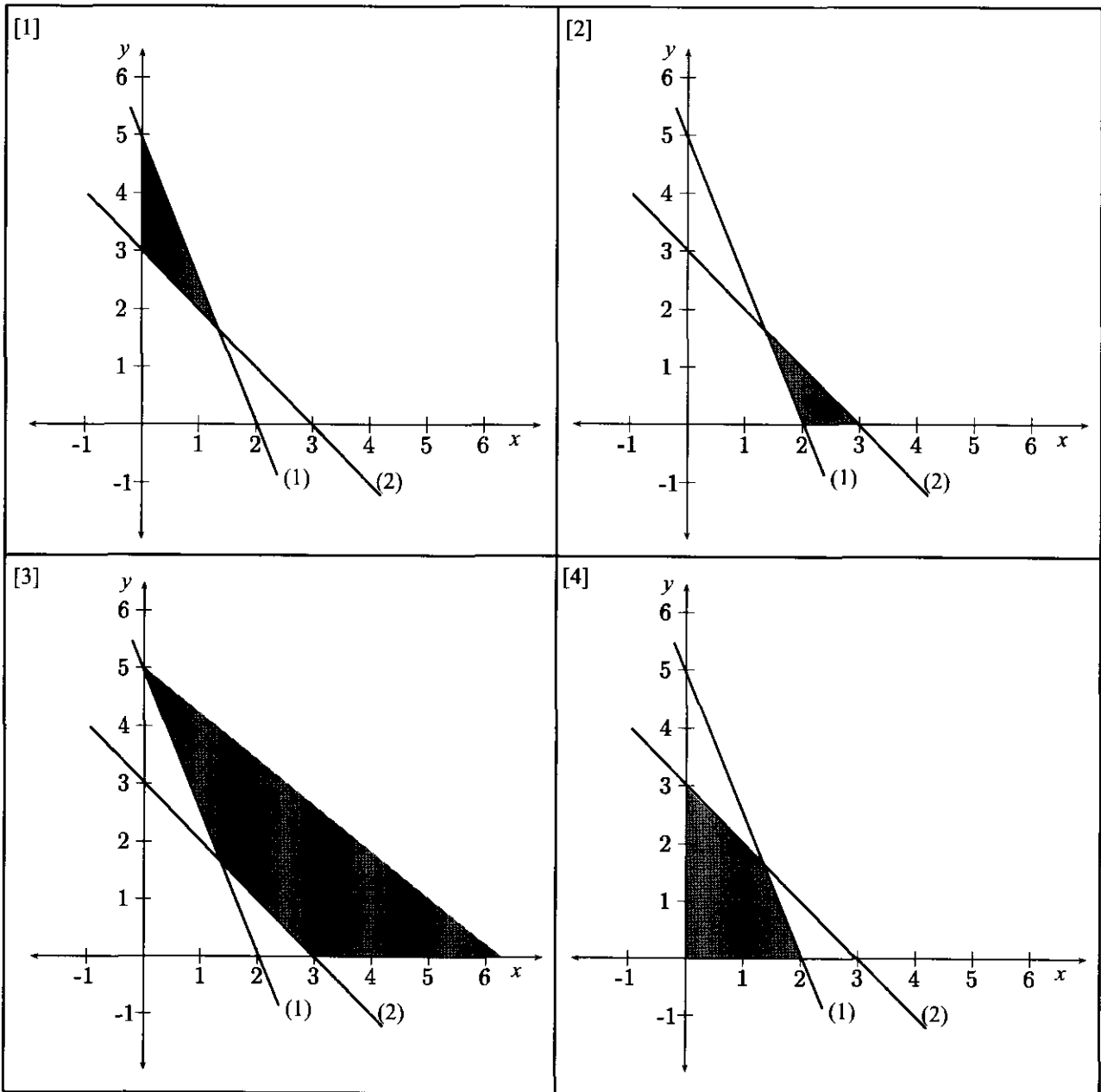
Choose the correct graphical representation of the following set of inequalities

$$y \geq 5 - 2,5x \quad (1)$$

$$y \leq 3 - x \quad (2)$$

$$x \geq 0 \quad (3)$$

$$y \geq 0 \quad (4)$$



[5] None of the above

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Question 18

Evaluate the following integral:

$$\int (x^2 + 2x) dx$$

- [1] $x^3 + 2x^2 + c$
- [2] $\frac{x^3}{2} + \frac{x^2}{2} + c$
- [3] $\frac{x^3}{3} + x^2 + c$
- [4] $3x^3 + 4x^2 + c$
- [5] None of the above

Question 19

If the total cost is given by

$$TC = 2Q^3 - Q^2 + 80Q + 150$$

what is the marginal cost when $Q = 10$?

- [1] 80
- [2] 118
- [3] 660
- [4] 2850
- [5] None of the above

Question 20

A swimming club provides x number of swimming lessons per day. The club has a daily fixed cost of R1 250 when offering lessons. The variable cost is R50 for each lesson given. Write down the linear equation for the total cost of the club per day.

- [1] Cost = $50x + 1\,250$
- [2] Cost = $1\,300x$
- [3] Cost = $1\,250x + 50$
- [4] Cost = $1\,200x$
- [5] None of the above

Please turn over for Section B

Question 22**12**

Consider the market for soccer balls defined by the following function:

$$\text{Demand: } P = 60 - 0,6Q$$

$$\text{Supply: } P = 20 + 0,2Q$$

where P and Q are the price and quantity respectively.

- (a) Draw the two functions on the grid below and determine the equilibrium point of the market graphically. (5)

(b) Calculate the consumer surplus for the demand function given in (a) if the market price is equal to R45. (4)

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(c) What is the difference between the quantity supplied and that demanded, if the price is equal to R25? (3)

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Question 23

4

Evaluate the following

$$\int x^2 (1 + \sqrt{x}) dx$$

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Question 24

4

A piece of cheese left in the refrigerator too long has become a biology experiment. The mould on the cheese is growing exponentially, and can be expressed as

$$N = 3e^{0,1x}$$

where x is the number of days in the refrigerator and N the amount of mould in grams. Determine after approximately how many days the mould would be equal to 6 grams.

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Question 25

10

The Soft-toy Company knows from past experience that if it charges p rand per teddy bear the number sold per week will be x teddy bears, where $p = 10 - 0,001x$. The cost to produce x teddy bears per week is given by $C = 5\,000 + 2x$ rand.

- (a) Write down the mathematical equations of the revenue and profit functions of the company. (4)

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- (b) Determine the profit if the company sold 2 000 teddy bears in one week. (2)

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- (c) How many teddy bears have been sold in a week if the company made a loss of a R5 000? (4)

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TOTAL

[100]

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ROUGH WORK

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PART 1 (GENERAL/ALGEMEEN) DEEL 1

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For use by examination invigilator
 Vir gebruik deur eksamenopsiener

IMPORTANT

- 1 USE ONLY AN HB PENCIL TO COMPLETE THIS SHEET
- 2 MARK LIKE THIS
- 3 CHECK THAT YOUR INITIALS AND SURNAME HAS BEEN FILLED IN CORRECTLY
- 4 ENTER YOUR STUDENT NUMBER FROM LEFT TO RIGHT
- 5 CHECK THAT YOUR STUDENT NUMBER HAS BEEN FILLED IN CORRECTLY
- 6 CHECK THAT THE UNIQUE NUMBER HAS BEEN FILLED IN CORRECTLY
- 7 CHECK THAT ONLY ONE ANSWER PER QUESTION HAS BEEN MARKED
- 8 DO NOT FOLD

BELANGRIK

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PART 2 (ANSWERS/ANTWOORDE) DEEL 2

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MARK READING SHEET INSTRUCTIONS

Your mark reading sheet is marked by computer and should therefore be filled in thoroughly and correctly

USE ONLY AN HB PENCIL TO COMPLETE YOUR MARK READING SHEET

PLEASE DO NOT FOLD OR DAMAGE YOUR MARK READING SHEET

Consult the illustration of a mark reading sheet on the reverse of this page and follow the instructions step by step when working on your sheet

Instruction numbers ① to ⑩ refer to spaces on your mark reading sheet which you should fill in as follows

- ① Write your paper code in these eight squares, for instance

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- ② The paper number pertains only to first-level courses consisting of two papers

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- ③ Fill in your initials and surname
- ④ Fill in the date of the examination
- ⑤ Fill in the name of the examination centre
- ⑥ WRITE the digits of your student number HORIZONTALLY (from left to right). Begin by filling in the first digit of your student number in the first square on the left, then fill in the other digits, each one in a separate square
- ⑦ In each vertical column mark the digit that corresponds to the digit in your student number as follows [-]
- ⑧ WRITE your unique paper number HORIZONTALLY
NB Your unique paper number appears at the top of your examination paper and consists only of digits (e.g. 403326)
- ⑨ In each vertical column mark the digit that corresponds to the digit number in your unique paper number as follows [-]
- ⑩ Question numbers 1 to 140 indicate corresponding question numbers in your examination paper. The five spaces with digits 1 to 5 next to each question number indicate an alternative answer to each question. The spaces of which the number correspond to the answer you have chosen for each question and should be marked as follows [-]
- ◆ For official use by the invigilator. Do not fill in any information here