



THE NCUK INTERNATIONAL FOUNDATION YEAR

IFYMB002 Mathematics Business Examination

2016-17

Examination Session

Semester Two

Time Allowed

2 Hours 40 minutes
(including 10 minutes reading time)

INSTRUCTIONS TO STUDENTS

SECTION A Answer ALL questions. This section carries 45 marks.

SECTION B Answer 4 questions ONLY. This section carries 80 marks.

The marks for each question are indicated in square brackets [].

- Answers must not be written during the first 10 minutes.
- A formula booklet and graph paper will be provided.
- An approved calculator may be used in the examination.
- Show **ALL** workings in your answer booklet.
- Examination materials must not be removed from the examination room.

**DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE
INVIGILATOR**

Section A

Answer ALL questions. This section carries 45 marks.

Question A1

Find the equation of the line which passes through the point $(-3, 7)$ and is parallel to the line with equation $4x + 3y - 15 = 0$.

Give your answer in the form $ax + by + c = 0$ where a, b and c are integers. **[3]**

Question A2

The probability that it rains on Monday is 0.4. If it rains on Monday, the probability that it rains on Tuesday is 0.3. If it does not rain on Monday, the probability it does not rain on Tuesday is 0.2.

Draw and label a tree diagram. Work out the probability that it rains on one day only. **[5]**

Question A3

The function $f(x)$ is defined as $f(x) = x^3 + 7x^2 - 10x - 16$.

Divide $f(x)$ by $(x + 8)$. *Show all working.* **[3]**

Question A4

A geometric series has common ratio 0.2 and sum to infinity 1500.

Find the first term and the 7th term. **[3]**

Question A5

Solve the equation

$$\frac{2^{x^2} \times 2^{45}}{2^{13x}} = 8 \quad \text{[4]}$$

All working must be shown

Question A6

Evaluate

$$\int_1^3 \frac{x^5 - x^2}{x^3} dx$$

Show all working. **[5]**

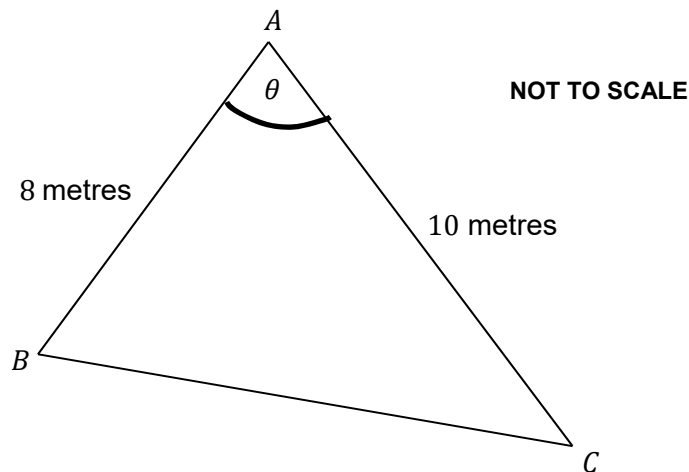
Question A7**Figure 1**

Figure 1 shows triangle ABC with $AB = 8$ metres, $AC = 10$ metres and angle $A = \theta$ where $\cos \theta = -\frac{1}{5}$.

[3]

Find the length of BC .

Question A8

Find the mean and standard deviation of the six readings below.

$-3, \quad 5, \quad 6, \quad 10, \quad 13, \quad 17.$

Give your standard deviation to 3 significant figures.

[4]

In this question, one mark will be given for the correct use of significant figures.

Question A9

Quarter	Number of houses sold	4-point moving average
1	$4p + 3$	
2	19	
		$5p - 1$
3	32	
4	$8p - 2$	

The table shows part of a record of house sales over 4 quarters.

Find the value of p .

[3]

Question A10

In a large forest, 45% of trees are conifers. A random sample of 20 trees is selected. **[3]**

If X is the number of conifers in this sample, find $p(6 \leq X < 10)$.

Question A11

A curve has equation

$$y = \frac{x^2}{x - 2}.$$

Find the equation of the tangent at the point (3, 9). **[5]**

Give your answer in the form $y = mx + c$.

Question A12

A student invests £480.

After 5 years the compound interest gained is £104.

Find the percentage rate. **[4]**

Section B
Answer 4 questions ONLY. This section carries 80 marks.

Question B1

- a) The line $y = kx + k^2$ is perpendicular to the line with equation $x + 4y = 1$.

Find the coordinates of the point where the line $y = kx + k^2$ crosses the x – axis. **[3]**

- b) Use substitution to solve the simultaneous equations

$$x - y = 7$$

$$2x^2 + y^2 = 38$$

All working must be shown. **[6]**

- c) i. When $8x^3 - 12x^2 + 6x + a$ is divided by $(2x - 1)$ the remainder is 8.

Find the value of a . **[2]**

- ii. The quadratic equation $4x^2 + bx + 9 = 0$ has two real and different roots.

Given that b is a positive integer, find the smallest value b can take. **[2]**

- d) i. An arithmetic series has first term 7 and the sum of the first 43 terms is 5719.

Find the common difference. **[3]**

- ii. A geometric series is defined as $4 + 12 + 36 \dots$

Find how many terms are needed before the sum of the series goes above 2 million. **[4]**

Question B2

- a) Two variables, x and t , are connected by the equation

$$x = 8e^{kt} - 12$$

where k is a constant.

When $t = 3$, $x = 500$.

- i. Show that $k = \ln 4$. *Each stage of your working must be clearly shown.* [3]
 - ii. Find the value of x when $t = \frac{7}{2}$. [2]
 - iii. Find the value of $\frac{dx}{dt}$ when $t = \frac{1}{2}$. [2]
 - iv. Explain why x can never equal -15 . [1]
- b) Solve the equations
- i. $\log_9 x = \frac{3}{2}$ [1]
 - ii. $\log_7 \left(\frac{1}{x} \right) = -3$ [1]
 - iii. $\log_x 243 = \frac{5}{4}$ [1]
- c) Solve $4 \cos^2 \theta = 3$ for $0 \leq \theta \leq \pi$. [4]
- Give your answers as exact multiples of π .

- d)

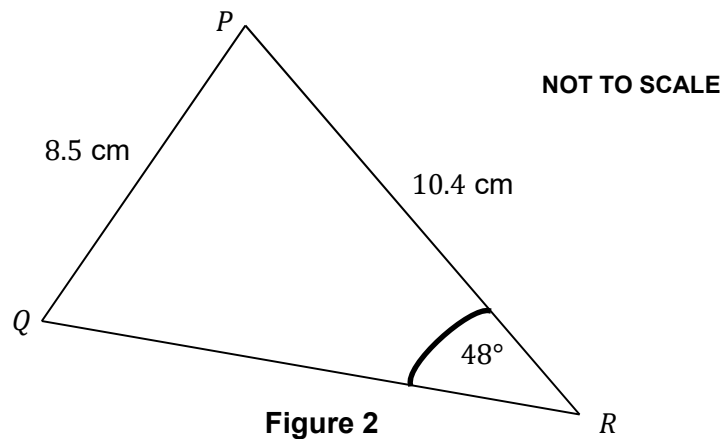


Figure 2 shows triangle PQR where $PQ = 8.5$ cm, $PR = 10.4$ cm and angle $R = 48^\circ$.

- i. Find angle Q . [2]
- ii. Find the area of triangle PQR . [2]
- iii. Find the shortest distance from point P to the line QR . [1]

Question B3

- a) A curve C has equation $y = 3x^4 - 8x^3 + 7$.
- Find $\frac{dy}{dx}$ [2]
 - Show that there are stationary values when $x = 0$ and $x = 2$. [2]
 - Confirm that there is a point of inflexion at $x = 0$ and determine whether there is a maximum or a minimum at $x = 2$. [5]
 - Sketch the curve C showing clearly the coordinates of the stationary values. (You do **not** need to show where the curve crosses the x - axis.) [2]

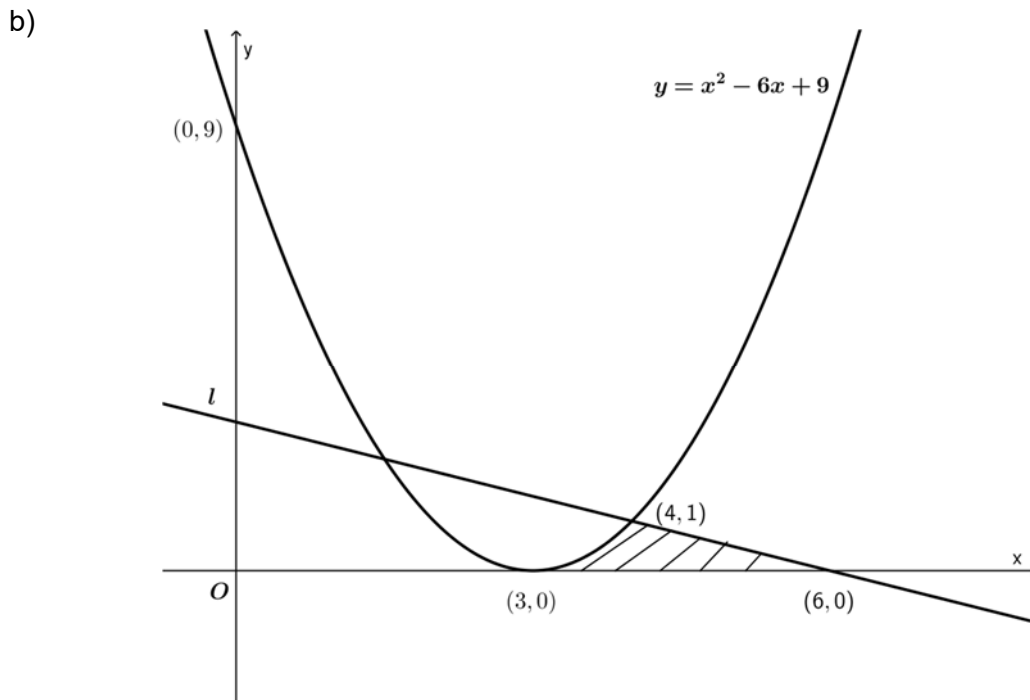
**Figure 3**

Figure 3 shows the curve $y = x^2 - 6x + 9$ which touches the x - axis at $(3, 0)$ and crosses the y - axis at $(0, 9)$. Line l crosses the curve $y = x^2 - 6x + 9$ at the point $(4, 1)$ and meets the x - axis at $(6, 0)$.

- Show that line l is a normal to the curve $y = x^2 - 6x + 9$. [3]
- Find the area, which is shaded, that is bounded by the line l , the curve $y = x^2 - 6x + 9$ and the x - axis. [6]

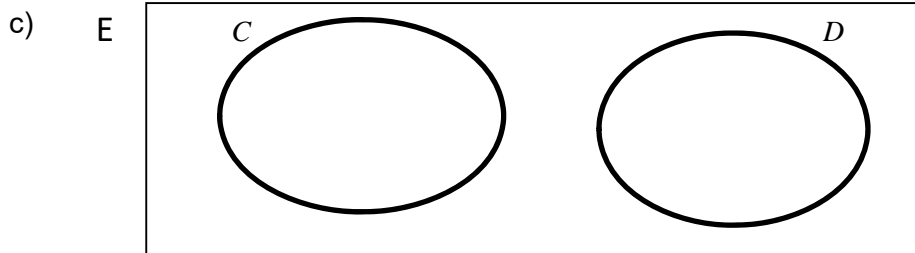
Question B4

- a) 80 customers at a shop paid by credit card and the times taken for each payment were recorded. The results are shown below.

Time, t , in seconds	Frequency
$3 \leq t \leq 4$	10
$4 < t \leq 5$	32
$5 < t \leq 6$	23
$6 < t \leq 7$	8
$7 < t \leq 8$	3
$8 < t \leq 9$	2
$9 < t \leq 10$	1
$10 < t \leq 11$	1

(You may wish to copy and extend this table to help you answer some of the following questions.)

- i. Estimate the mean. [3]
 - ii. **On graph paper**, draw a cumulative frequency curve. [4]
 - iii. Use your cumulative frequency curve to estimate the median. [1]
 - iv. Does the distribution appear to be skewed? Give a reason. [2]
- b) A and B are two events such that $p(A) = 0.4$ and $p(B) = 0.75$.
Events A and B are independent.
- i. Find $p(A \cap B)$ and $p(A \cup B)$. [2]
 - ii. Draw a Venn diagram to show these probabilities. [3]
 - iii. Hence work out $p(A' \cap B)$, $p(A \cup B')$ and $p(A' | B)$. [3]



The Venn diagram above shows two other events C and D .
Are events C and D mutually exclusive? Give a reason.

[2]

Question B5

- a) In a small college, a record is kept of the mean daytime temperature each month and the number of litres of drinking water which are dispensed by a vending machine. The survey is carried out over six months. The results are shown below.

Mean daytime temperature (x) in °C	Number of litres dispensed (y) (to nearest whole number)
7	13
11	21
13	23
16	28
17	26
20	33

The results can be summarised as follows:

$$\sum x = 84; \quad \sum y = 144; \quad \sum x^2 = 1284; \quad \sum y^2 = 3688; \quad \sum xy = 2171$$

- i. Find s_x , s_y and s_{xy} . [4]
Hence find the correlation coefficient.

- ii. Find the equation of the regression line of y on x . [2]
Give your answer in the form $y = mx + c$. *Show all working.*

The machine that dispensed the water was found to be faulty and the amount dispensed each month was 0.5 litres less than what was recorded.

- iii. Without doing any further calculations, write down the correlation coefficient and the equation of the regression line of y on x when the adjusted amounts of water are used. [3]

- b) Bags of cement have a mean mass of 25 kg. The masses of the bags can be assumed to follow a Normal distribution.

93.32% of the bags have a mass of less than 25.3 kg.

- i. What percentage of bags are below 24.5 kg? [3]

- ii. Find the standard deviation. [3]

- c) A discrete random variable, X , has probability distribution as given in the table below.

x	1	3	5	7
$p(X = x)$	0.14	0.17	$2a$	a^2

- i. Find the value of a . [3]

- ii. Find $E(X)$. [2]

Question B6

a) A curve C has equation $-2x^2 + 8xy^2 - y^3 = 7$.

i. Find $\frac{dy}{dx}$ in terms of x and y . **[4]**

ii. What can you say about curve C at the point $(2, 1)$? **[2]**

b) i. Write $\frac{2}{1-x^2}$ in the form $\frac{A}{1+x} + \frac{B}{1-x}$ where A and B are constants to be determined. **[3]**

ii. You are given

$$\int_0^a \frac{2}{1-x^2} dx = \ln\left(\frac{2}{3}\right)$$

Find the value of a . **[7]**

c) **Use the substitution** $u = x + 3$ to find

$$\int \frac{x}{x+3} dx$$
[4]

This is the end of the examination.

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