

NCUK

THE NCUK INTERNATIONAL FOUNDATION YEAR

IFYMB002 Mathematics Business Examination 2017-18

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 is parallel to the line with equation $x + 3y + 1 = 0$ and passes through the point (3, 7).

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

Question A2

Three letters are selected, one after the other with no replacement, from the word ASSESSMENTS.

Find the probability that all three letters are 'S'. **[3]**

Question A3

Use the Remainder Theorem to find the remainder when $2x^3 + 5x^2 - 6x - 24$ is divided by $(x - 2)$.

What can you say about $(x - 2)$ in relation to $2x^3 + 5x^2 - 6x - 24$? **[3]**

Question A4

The common ratio of a geometric series is $\frac{9}{10}$.

The 4th term is 271 less than the first term.

Find the first term and the sum to infinity. **[5]**

Question A5

Simplify

$$2\log_{10}5 + \frac{1}{2}\log_{10}64 - \frac{1}{3}\log_{10}8$$

Your final answer must contain no logarithms.

All working must be shown. An answer, even the correct one, will receive no marks if this working is not seen. **[4]**

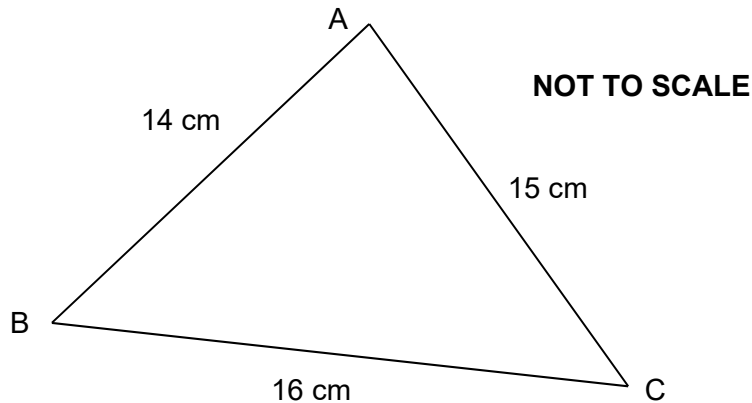
Question A6**Figure 1**

Figure 1 shows acute-angled triangle ABC with AB = 14 cm, AC = 15 cm and BC = 16 cm.

Find the size of angle A in degrees, and to **3** significant figures.

In this question, 1 mark will be given for the correct use of significant figures. **[4]**

Question A7

By using integration, find the possible values of a if

$$\int_0^a (4x + 3) = 35. \quad \text{[4]}$$

Question A8

Two events are such that $p(A|B) = \frac{5}{8}$, $p(B|A) = \frac{5}{6}$ and $p(B) = \frac{4}{5}$.

Find $p(A)$ and $p(A \cup B)$. **[4]**

Question A9

Three experiments, X, Y and Z were carried out to find the product moment correlation coefficient between two sets of readings in each case. The correlation coefficient for experiment X was -0.3 , for experiment Y it was 0.92 and for experiment Z it was -0.07 .

Describe each correlation in words. **[3]**

Question A10

The lengths of planks of wood can be assumed to follow a Normal distribution with standard deviation 6 cm.

A sample of 9 planks was taken and the mean length was found to be 200 cm.

Find a 95% confidence interval for the mean length of all the planks. **[3]**

Question A11

A curve has equation

$$y = \frac{4x + 2}{x + 3}.$$

Find the two sets of coordinates where the gradient of the tangent to the curve is $\frac{2}{5}$.

[4]**Question A12**

Use integration by parts to find

$$\int 16x^2 e^{2x} dx.$$

All working must be shown.

[5]

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

Question B1

- a) The line with equation $4x + 3y + 24 = 0$ meets the x – axis at point X and the y – axis at point Y.
 Find the length of XY. **[3]**
- b) Use substitution to solve the equations $2x - y = 7$
 $4x^2 + y^2 = 37$ **[6]**
- c) i. Solve $\frac{3x + 8}{4} > 5$ **[1]**
- ii. Solve $x^2 \leq 36$. **[2]**
- iii. List the integers which satisfy **both** $\frac{3x + 8}{4} > 5$ **and** $x^2 \leq 36$. **[1]**
- d) The common difference of an arithmetic series is 6 and the 12th term is 16.
- i. Find the first term. **[2]**
- ii. Find the sum of the first 35 terms. **[3]**
- e) Find the coefficient of the term in x^4 in the expansion of $(2 + \frac{1}{2}x)^{10}$. **[2]**

Question B2

- a) Two variables, x and y , are connected by the formula

$$y = 320 (2^{kx}) + 15.$$

When $x = 2, y = 20$.

- i. Find the value of k . **[3]**
- ii. Find the value of y when $x = \frac{2}{3}$. **[2]**

For any value of x , y is always greater than C .

- iii. State the value of C . **[1]**

- b) Solve the equations

i. $\log_x 512 = 3$ **[1]**

ii. $\log_4(3x) - \log_4(x + 4) = \frac{1}{2}$. *All working must be shown.* **[4]**

- c)

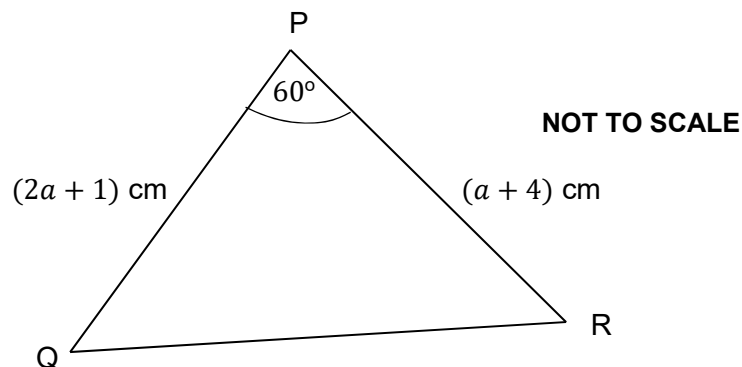


Figure 2

Figure 2 shows acute-angled triangle PQR with $PR = (a + 4)$ cm, $PQ = (2a + 1)$ cm and angle $P = 60^\circ$.

The area of triangle PQR is $15\sqrt{3}$ cm².

Find the value of a . **[4]**

- d) Solve $\sin^2(\theta + 50^\circ) = \frac{1}{4}$ for $0 \leq \theta \leq 360^\circ$. **[5]**

Question B3

a)

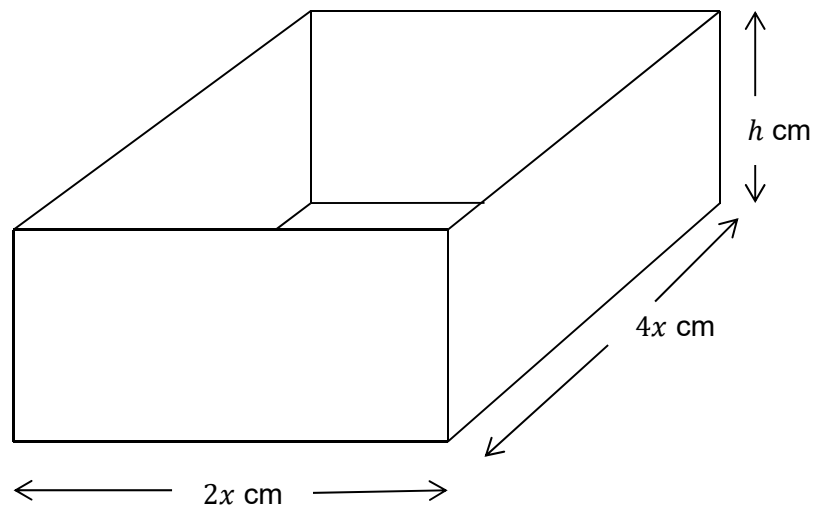
**Figure 3**

Figure 3 shows a box in the shape of a cuboid which is $4x$ cm long, $2x$ cm wide and h cm high. The outside surface area is 1536 cm^2 .

The box has a base **but it has no top**.

i. Express h in terms of x . **[2]**

ii. Show that the volume of the box, V , is given by

$$V = 1024x - \frac{16x^3}{3} \quad \mathbf{[3]}$$

iii. Use $\frac{dV}{dx}$ to find the value of x which gives the maximum volume. **[4]**

iv. Confirm that your volume is a maximum. **[3]**

Part b) is on the next page.

Question B3 – (continued)

b)

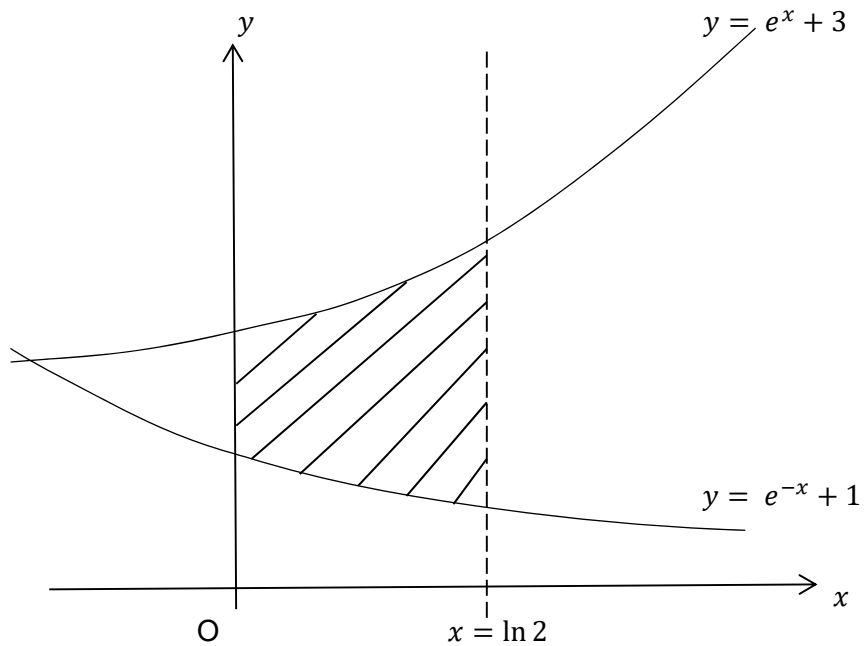


Figure 4

Figure 4 shows the curves $y = e^x + 3$ and $y = e^{-x} + 1$. The line $x = \ln 2$ is also shown.

- i. Find the area, which is shaded on the diagram, that is bounded by both of the curves, the line $x = \ln 2$ and the y – axis. *Show all working.* [4]

The point $P(\ln 4, 7)$ lies on the curve $y = e^x + 3$.

- ii. Find the equation of the normal at point P. [3]
- iii. Explain why the curve $y = e^x + 3$ has no stationary values. [1]

Question B4

- a) The numbers of students absent in a college were recorded over 50 days. The results are shown in the table below.

Number of absentees	Frequency
0 – 4	19
5 – 9	14
10 – 16	9
17 – 23	5
24 – 32	3

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

- i. Are these readings an example of discrete data or continuous data? Give a reason. **[2]**
- ii. Estimate the mean and standard deviation. **[6]**
- iii. In which interval does the median lie? **[1]**
- iv. Two days were selected at random. Find the probability that 17 or more students were absent on both days. **[2]**
- b) A student drives to college and has to pass through two different sets of traffic lights. The probability that she stops at the first set is 0.6. If she stops at the first set, the probability that she stops at the second set is 0.7. If she does not stop at the first set, the probability that she stops at the second set is 0.2.
- i. Draw a fully labelled tree diagram. **[2]**
- ii. Find the probability that she stops at least once. **[2]**
- iii. Find the probability that she stops at the second set. **[3]**

You are given the student stops at the second set of traffic lights.

- iv. Find the probability that she stopped at the first set. **[2]**

Question B5

- a) Ten shops took part in a survey on the numbers of staff they employed (x) and their daily turnover (y) in thousands of pounds. The data can be summarised as follows:

$$\sum x = 60; \quad \sum y = 210; \quad \sum x^2 = 660; \quad \sum y^2 = 6880; \quad \sum xy = 1840.$$

- i. Find s_x , s_y and s_{xy} . **[3]**
- ii. Hence find the product moment correlation coefficient. **[1]**
- b) The numbers of bottles of water sold in a shop were recorded over 6 weeks in the summer. The results are shown in the table below.

Week	Number of bottles sold	4-point moving average
1	124	
2	136	
		139
3	140	
		a
4	156	
		156
5	160	
6	b	

- i. Find the values of a and b . **[2]**
- ii. Can you use these results to predict likely sales in 6 months' time? Give a reason. **[2]**
- c) A car was bought on 1 July 2012 and had fallen by 15% of its value to £5100 by 1 July 2013.
- i. Find the value of the car on 1 July 2012. **[2]**
- ii. The car then fell by 10% of its value each year over the next 3 years. Find how much the car was worth on 1 July 2016. **[2]**
- iii. Find the **total** percentage loss over the 4 years from 1 July 2012 to 1 July 2016. **[2]**

Part d) is on the next page.

- d) A student practises goal scoring in football. The probability that he scores a goal with any one shot is 0.4 and he has 15 shots. Out of these 15 shots:
- i. find the probability that he scores 4 or less goals. **[1]**

 - ii. find the probability that he scores more than 7 goals. **[2]**

 - iii. find the probability that he scores exactly 6 goals. **[2]**

 - iv. what important assumption are you making? **[1]**

Question B6 is on the next page.

Question B6

a) The curve C has equation $12x + y^2 - 5y - 3x^2 = 18$.

i. Find $\frac{dy}{dx}$ in terms of x and y . **[3]**

ii. State the value of x when $\frac{dy}{dx} = 0$. **[1]**

iii. Hence find the coordinates of the two stationary values on curve C . **[3]**

b) i. Express $\frac{4x^2 + 22x + 29}{x^2 + 5x + 6}$ in the form $A + \frac{2x + 5}{x^2 + 5x + 6}$ where A is a constant to be determined. **[1]**

ii. Express $\frac{2x + 5}{x^2 + 5x + 6}$ in the form $\frac{B}{x + 2} + \frac{C}{x + 3}$ where B and C are constants to be determined. **[3]**

iii. Hence evaluate

$$\int_0^3 \frac{4x^2 + 22x + 29}{x^2 + 5x + 6} dx.$$

Give your answer in the form $p + \ln q$ where p and q are integers.

All working must be shown. An answer, even the correct one, will receive no marks if this working is not seen. **[5]**

c) Use the substitution $u = \tan x$ to evaluate

$$\int_0^{\frac{\pi}{3}} \frac{\tan^5 x}{\cos^2 x} dx.$$

All working must be shown. An answer, even the correct one, will receive no marks if this working is not seen. **[4]**

This is the end of the examination.