IB · DP · Maths

1 hour 13 questions

Practice Paper 1

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Total Marks /80

1 (a) In a trial for a new drug, scientists found that the amount of the drug in the bloodstream decreased over time, according to the model

$$D(t) = 1.4 \, X \, 0.77^t, \qquad t \geq 0$$

where D is the amount of the drug in the bloodstream in mg per litre (mg L^{-1}) and t is the time in hours.

Write down the amount of the drug in the bloodstream at $t = 0$.

(1 mark)

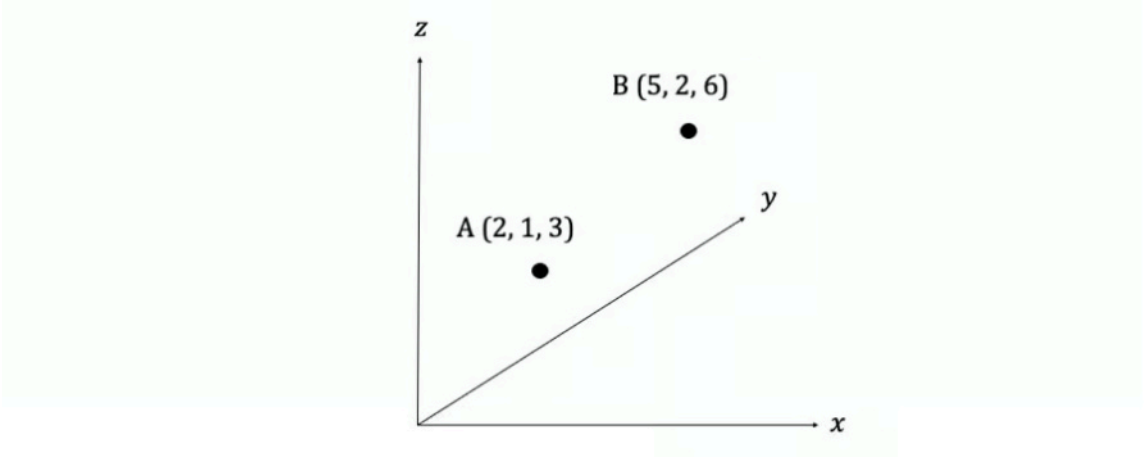
(b) Calculate the amount of the drug in the bloodstream after four hours.

(2 marks)

(c) Calculate the time, in hours, for the amount of the drug in the bloodstream to decrease to 0.22 mg L^{-1}.

(3 marks)

2 (a) Two points, A (2, 1, 3) and B (5, 2, 6), are located on an xyz coordinate grid as shown in the diagram below.



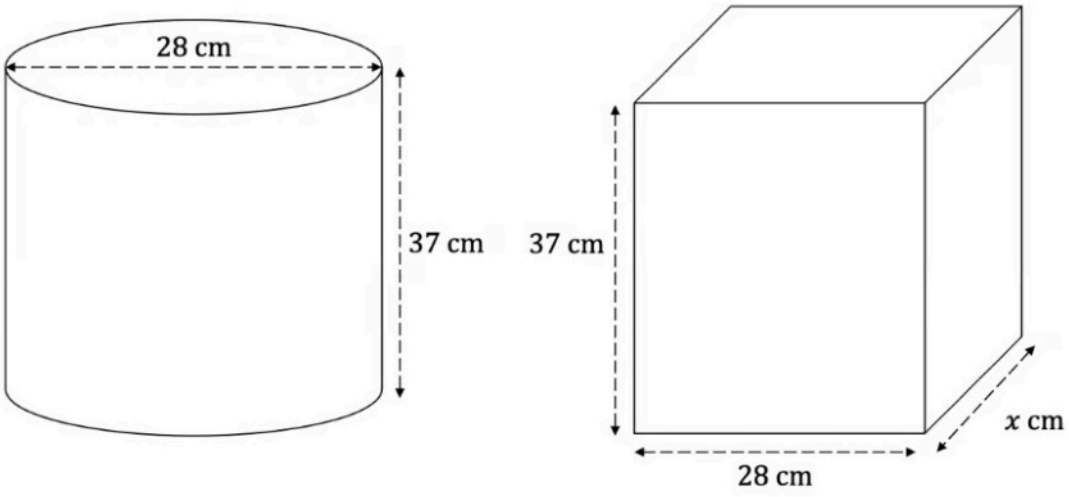
Find the length of AB.

(2 marks)

(b) Find the coordinates of the midpoint of [AB].

(2 marks)

3 (a) Vivian has two containers. The first container is in the shape of a cylinder with diameter 28 cm and height 37 cm. The second container is in the shape of a cuboid with width 28 cm, height 37 cm and length x cm.



Calculate the surface area of the first container.

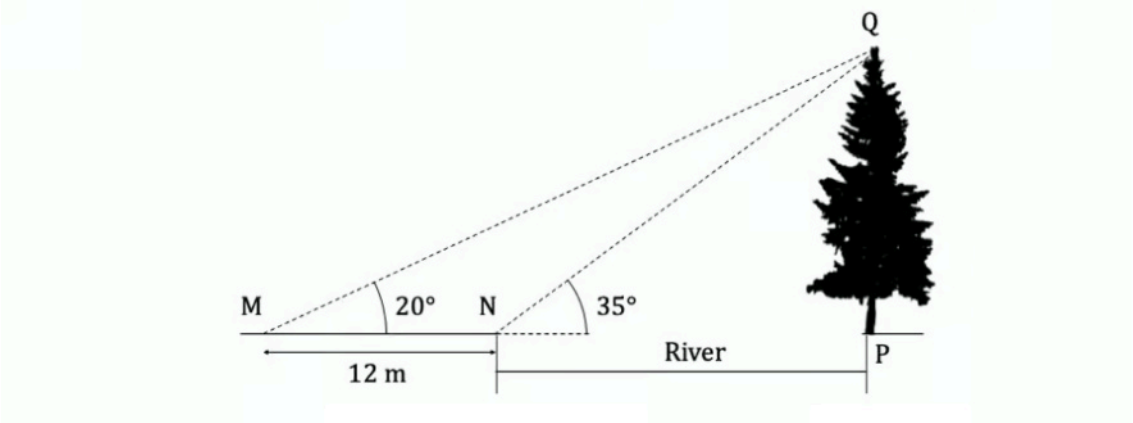
(3 marks)

(b) Both containers have the same surface area.

Find the value of x.

(4 marks)

4 (a) Adah would like to estimate the height of a tree located at point P on the edge of a riverbank, with the top of the tree at point Q. However, due to a raging river, she is unable to reach the base of the tree. From point M she measures an angle of elevation of 20° to the top of the tree, and then from point N (which is on the edge of Adah's bank of the river) she measures an angle of elevation of 35° to the top of the tree. Between the points M and N she measures a horizontal distance of 12 m. Points M, N and P all lie on a single horizontal line, and point Q is vertically above point P. The diagram below shows this information.



Calculate the length of NQ.

(3 marks)

(b) Calculate the height of the tree.

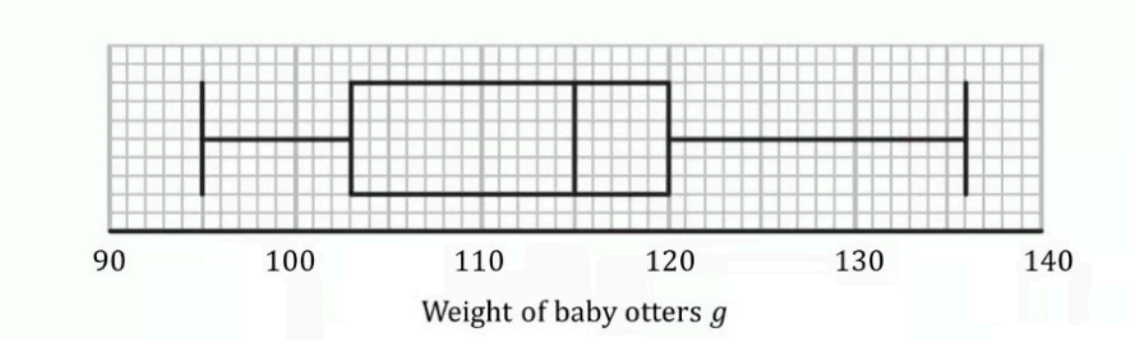
(2 marks)

(c) Adah borrows a boat and crosses the river at a rate of 50 metres per 15 minutes.

Assuming that she crosses in a straight line directly from point N to point P, find out how long it takes her to cross the river.

(3 marks)

5 Jeanette works for a conservation charity who rescue orphaned otters. Over many years she records the weight (g) of each otter when it first arrives. The data is illustrated in the following box and whisker diagram:



Using the box plot above:

i) Write down the median weight of the otters.

ii) Write down the lower quartile.

iii) Find the interquartile range.

(4 marks)

6 (a) The line l_1 passes through the points (1, 7) and (5, 5).

Find the equation of l_1. Give your answer in the form of $y = mx + c$.

(2 marks)

(b) A new line, l_2, is perpendicular to l_1 and passes through the point (4, 8).

Find the equation of l_2. Give your answer in the form of $y = mx + c$.

(2 marks)

(c) The point Z is the intersection of l_1 and l_2.

Find the coordinates of Z.

(2 marks)

7 (a) A function is defined by $f(x) = 4 - \frac{12}{5x+9}$, for $-8 \leq x \leq 8, x = -\frac{9}{5}$.

Find the range of f.

(3 marks)

(b) Find the value of $f^{-1}(2)$. Give your answer as a fraction.

(2 marks)

8 (a) It is claimed that women from Japan are taller on average than women from India. The heights, in cm, of 11 women from each country have been collated in the table below.

Japan	India
173.0	155.2
158.2	157.8
148.5	156.0
150.6	142.7
168.7	149.6
149.8	150.1
158.8	152.6
155.3	148.2
159.2	151.3
158.9	147.6
166.0	168.0

A t-test is to be performed at the 5% significance level.

State the null and alternative hypotheses.

(2 marks)

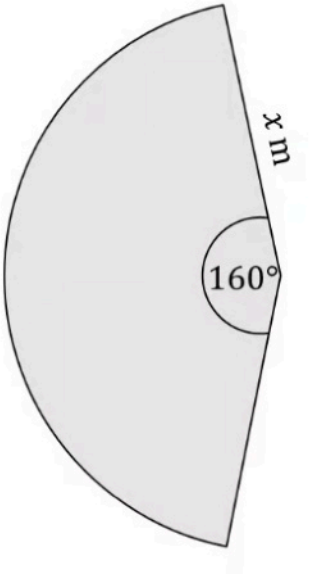
(b) Find the p-value for this test.

(2 marks)

(c) State whether or not the initial claim is justified. Give a reason for your answer.

(2 marks)

9 (a) A lawn sprinkler sprays water over a lawn covering an arc of 160° with a maximum spray distance of x m as shown in the diagram below. The lawn sprinkler waters 20 m^2 of the lawn.



Calculate the value of x.

(4 marks)

(b) Calculate the length of the outer arc.

(3 marks)

10 (a) Daniel and Jonah have each been given $5000 to save for university.

Daniel invests his money in an account that pays a nominal annual interest rate of 2.24%, **compounded quarterly**.

Calculate the amount Daniel will have in his account after 8 years. Give your answer to 2 decimal places.

(3 marks)

(b) Jonah wants to invest his money in an account such that his investment will double in 10 years. Assume the account pays a nominal annual interest of r0/o, **compounded half-yearly**.

Determine the value of r.

(3 marks)

11 (a) A carpet salesman in interested how his sales are distributed and records his sales results over a period of six months. The data is shown in the table.

Month	January	February	March	April	May	June
Number of sales	16	12	14	20	15	19

A chi-squared goodness of fit test is to be performed on the data at the 5% significance level to find out whether the data fits a uniform distribution.

The critical value for the test is 11.070 and the hypotheses are

H_0 : The data satisfies the model.
H_1 : The data does not satisfy the model.

Find an estimate of how many carpets the salesman expects to sell each month.

(1 mark)

(b) Write down the number of degrees of freedom for this test.

(1 mark)

(c) State the conclusion of the test. Give a reason for your answer.

(4 marks)

12 (a) The function $g(x) = ax^2 + bx + c$ intercepts the y-axis at —16, has an x-intercept when x = —4 and can be obtained by an appropriate translation of the graph $y = 2x^2$.

i) Find the values of a, b and c.

ii) Write down $g(x)$.

(4 marks)

(b) Find the other x-intercept of $g(x)$.

(1 mark)

(c) Write down the coordinates of the vertex of $g(x)$.

(2 marks)

13 (a) A rice farm sells x kg of rice every week.

It is known that $\frac{dP}{dx} = -0.02x + 6,\ x \geq 0$ where P is the weekly profit, in dollars ($), from the sale of x kg of rice.

Find the amount of rice, in kg, that should be sold each week to maximise the profit.

(3 marks)

(b) The profit from selling 250 kg of rice is $480.

Find $P(x)$.

(5 marks)