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TOTAL
MARKS

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INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
MAY 2024

MATHEMATICS: PAPER II

EXAMINATION NUMBER

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Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 28 pages and an Information Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the space provided.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
8. Round off to **ONE DECIMAL PLACE** unless otherwise stated.
9. It is in your own interest to write legibly and to present your work neatly.
10. Three blank pages (pages 26 and 28) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	TOTAL
13	6	6	25	15	10	8	12	7	4	7	14	8	7	8	150

SECTION A**QUESTION 1**

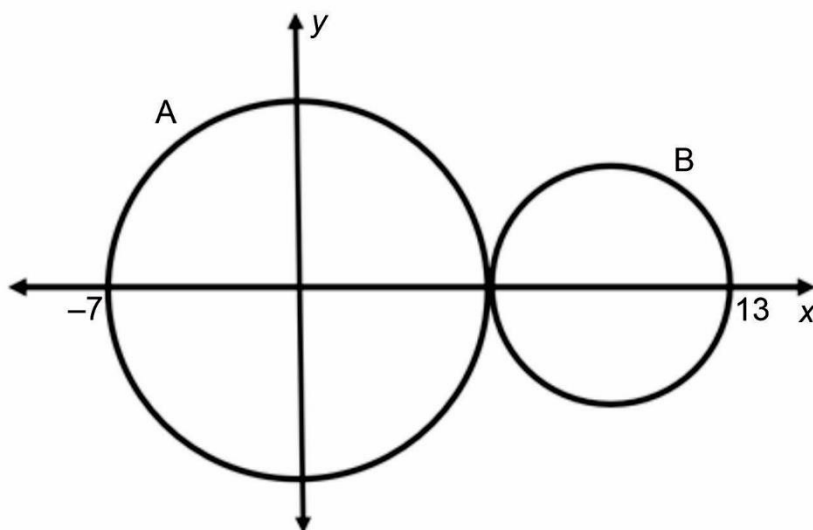
- (a) Given the points A, B and C having coordinates, $A(-3;2)$, $B(0;-3)$ and $C(k;4)$. Determine the value of k for which:

(1) Points A, B and C are collinear (all lie on the same straight line). (3)

(2) Triangle ABC is right-angled at B (i.e. $AB \perp BC$). (3)

(3) The angle of inclination of AC with the x-axis is 45° . (2)

- (b) Consider the following diagram showing two circles, Circle A with centre $(0;0)$ and Circle B:



Determine the equation of each of the circles if the common tangent to Circle A and Circle B is perpendicular to the x-axis at the common x-intercept: (5)

[13]

QUESTION 2

A company employs seven salespersons. The commission that each salesperson earned (in Namibian dollars) in a certain month is shown below.

3 900 5 700 10 600 13 600 15 100 15 800 17 100

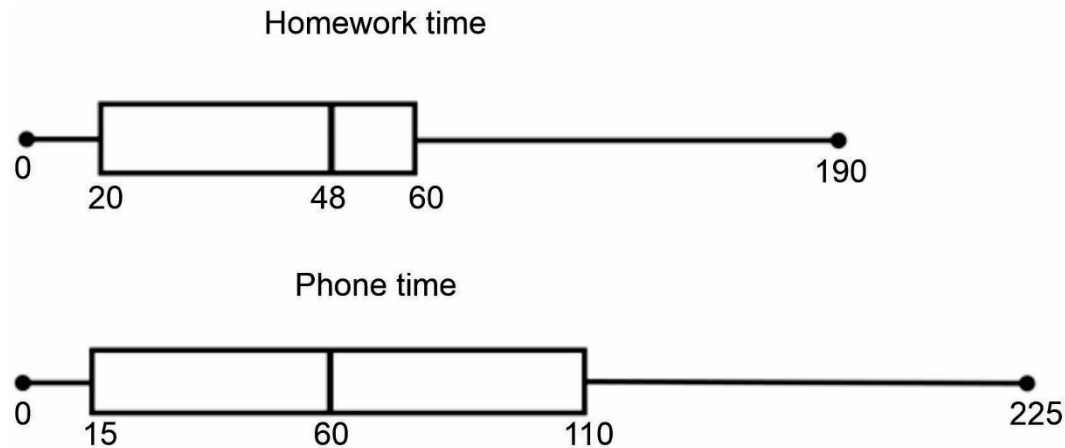
- (a) Calculate the mean of the data. (1)
- (b) Calculate the standard deviation of the data. (2)
- (c) The company rates the staff according to the amount of commission earned. A salesperson whose commission is more than one standard deviation above the mean receives a rating of 'good'. How many salespersons will receive a rating of 'good' for that month? Show all working. (3)

[6]

QUESTION 3

A group of Grade 12s were asked how much time they spent on their phones per night compared to how much time they spent on their homework. Two box-and-whisker plots are drawn below to compare the results. Time is given in minutes.

Phone and homework minutes per night:



- (a) What percentage of Grade 12s use their phones for at least 15 minutes per night? (1)
- (b) What is the upper quartile for the phone time data? (1)
- (c) Is it more common for the Grade 12 group of pupils at this school to spend more than one hour on their homework or more than one hour on their phones? Explain. (2)
- (d) Discuss the skewness of the homework data. (2)

[6]

QUESTION 4

(a) Simplify to a single trigonometric ratio: $\frac{\sin(180^\circ + 2\theta)}{2 \sin(90^\circ - \theta)}$ (4)

(b) Evaluate, without using a calculator: $(\cos 75^\circ - \sin 75^\circ)(\cos 75^\circ + \sin 75^\circ)$ (4)

(c) Solve for x : $5^{\tan x} = \frac{1}{5}$ for $x \in [-90^\circ; 180^\circ]$ (3)

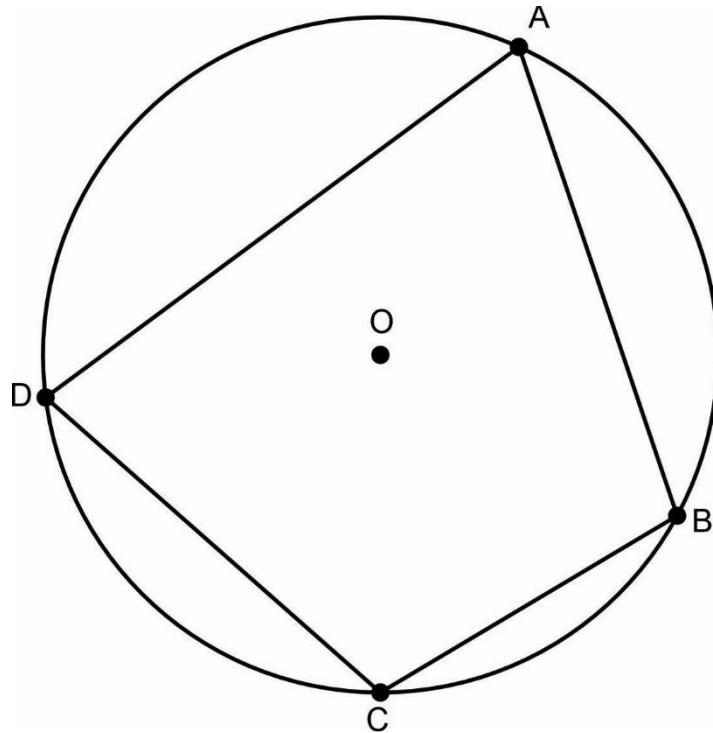
(d) If $\sin 36^\circ = k$, determine, without using a calculator, the value of $\cos 72^\circ$. (3)

(e) Give the general solution for x if $\sin x = \frac{1 + \cos 2x}{1 + \sin x}$ (6)

(f) Prove that $\frac{3 \cos 2\beta + \cos \beta - 2}{3 \sin 2\beta - 5 \sin \beta} = \frac{\cos \beta + 1}{\sin \beta}$ (5)

QUESTION 5

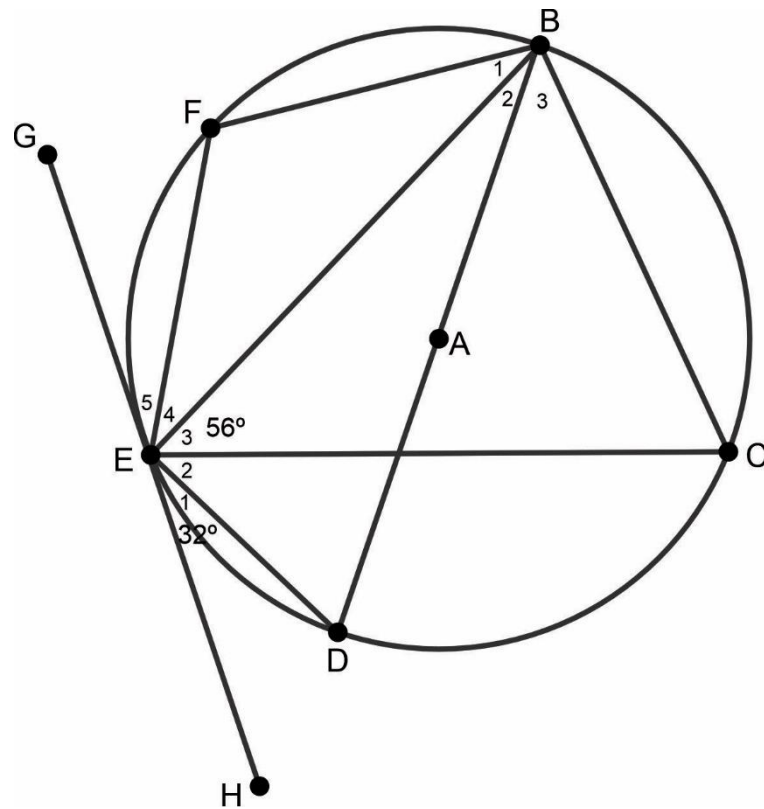
- (a) In the figure below, A, B, C and D are points on the circumference of the circle with centre O.



- (1) What type of quadrilateral is ABCD? (1)

- (2) Using the diagram above, prove the theorem that states that $\hat{A} + \hat{C} = 180^\circ$. (5)

(b) In the diagram below, A is the centre of the circle. BD is a diameter of the circle.



GEH is a tangent to the circle at E. F and C are two points on the circle and FB, FE, BC, CE and BE are drawn. $\hat{E}_1 = 32^\circ$ and $\hat{E}_3 = 56^\circ$. Calculate, with reasons, the values of:

(1) $\hat{E}_2$

(2)

(2) $\hat{EBC}$

(3)

(3) $\hat{F}$

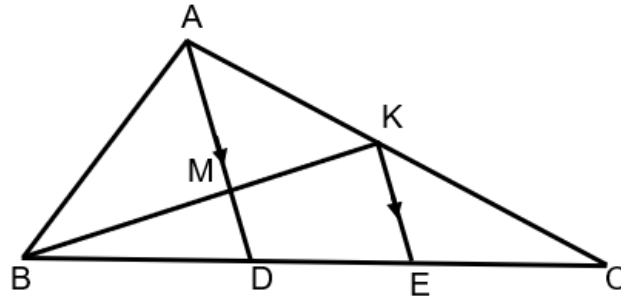
(4)

[15]

QUESTION 6

In the figure, triangle ABC has D and E on BC. BD = 8 cm and DC = 12 cm.

AK : KC = 2 : 1 and AD // KE. **Give reasons where applicable.**

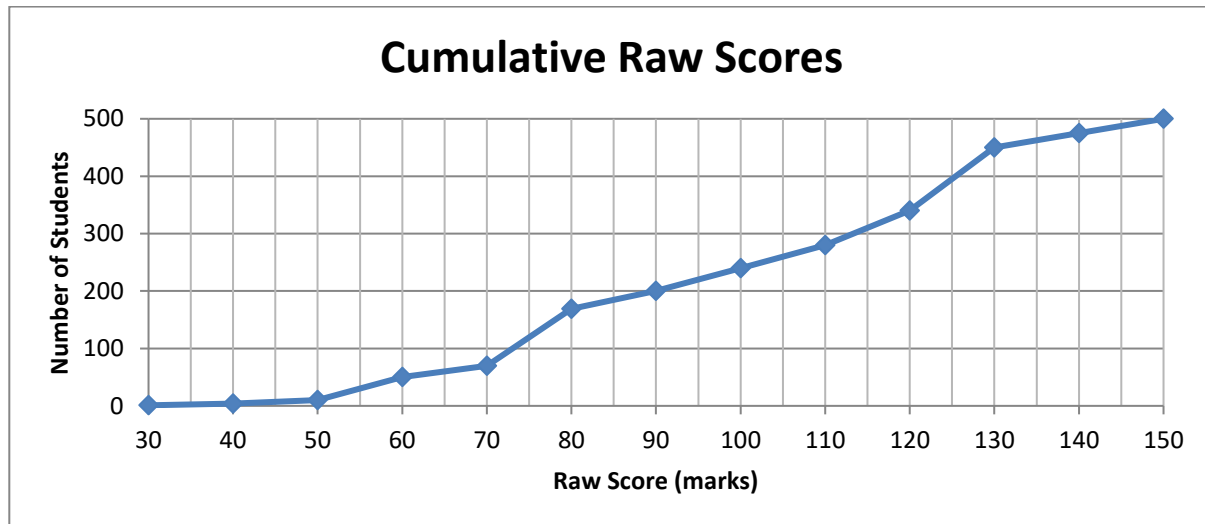


- (a) Write down the numerical value of $\frac{CE}{ED}$. (2)
- (b) Show that D is the midpoint of BE. (2)
- (c) If MD = 3 cm, calculate the length of KE. (2)
- (d) Calculate the numerical value of $\frac{\text{area } \triangle KEC}{\text{area } \triangle KBC}$. (4)

[10]**75 marks**

SECTION B**QUESTION 7**

An exam, marked out of 150 marks, is written by a large group of students. The cumulative frequency graph for the marks is given below.



(a) How many students wrote the test? (1)

(b) What is the probability that a student, chosen at random, will have a score of more than 60%? (3)

- (c) During the moderation process it was decided to adjust the raw scores. Two options were discussed:

Option 1: add 7,5 marks to each student's raw score.

Option 2: add 10% of the marks they did not get.

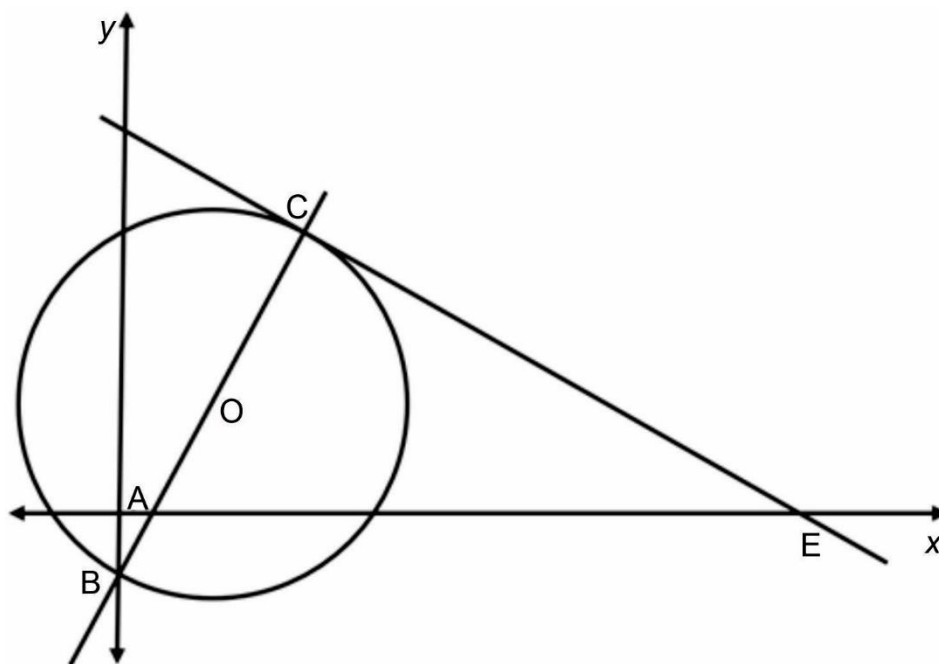
For example: A student who scored 100 marks gains 5 marks.

A student who scored 80 marks gains 7 marks.

- (1) How will option 1 affect the raw mean and standard deviation? (2)

- (2) How will option 2 affect the raw mean and standard deviation? (2)

[8]

QUESTION 8

(Diagram is not drawn to scale.)

Given above is the circle $x^2 + y^2 - 4x - 2y - 3 = 0$ with centre O and straight line $y - x + 1 = 0$. This line intersects the circle at B and C.

- (a) Show that the line passes through the centre of the circle O. (4)

(b) Find the equation of the tangent to the circle at $C(4;q)$. (4)

(c) If this tangent has the equation $y = -x + 7$ and cuts the x-axis at E, determine the *area of triangle* CAE. (4)

[12]

QUESTION 9

Cellphone numbers in Eswatini have 10 digits.



- (a) How many different cellphone numbers are possible if all numbers must start with a zero, the second number may not be a zero and digits may be repeated? (2)
- (b) A new service provider has come into the country and has decided that their 10-digit cellphone number will begin with a zero, but their numbers will have four even digits, followed by five odd digits. How many numbers can be created in this way if digits can be repeated? (2)
- (c) Determine the probability that a service provider randomly offers you the number 0813625898. (3)

[7]

QUESTION 10

A Grade 12 learner from Gaborone is attempting to pass his driver's test. The probability that he passes his first test is $\frac{3}{5}$. At any further attempt the probability that he passes is $\frac{9}{10}$.

- (a) Draw a tree diagram that illustrates the probabilities of passing at the first, second and third attempt. (2)

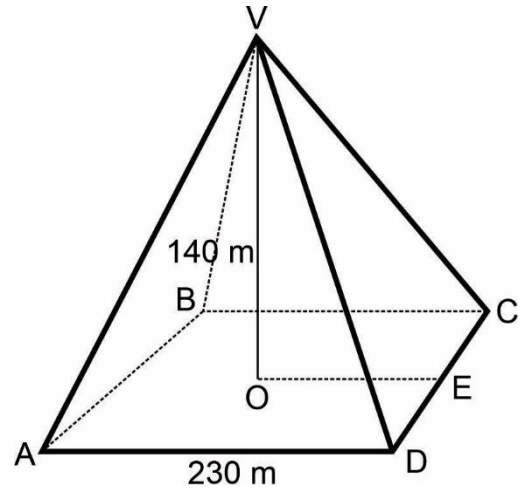
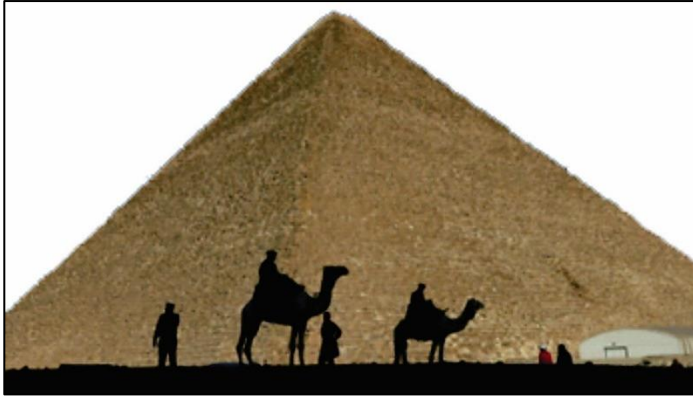
- (b) Find the probability that he needs no more than two attempts to pass the test. (2)

[4]

QUESTION 11

The pyramid of Giza is situated near Cairo. It has a height of 140 metres and a square base with sides of length 230 metres.

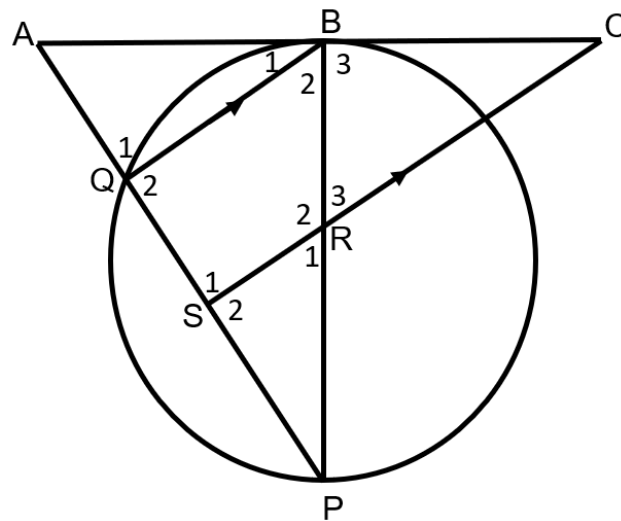
In the sketch below, O is on the same horizontal plane as ABCD. VO is the perpendicular height of the pyramid. E is the midpoint of CD.



(a) Calculate the magnitude of $\hat{VEO}$. (3)

(b) Calculate the surface area of one triangular face of the pyramid. (4)

[7]

QUESTION 12

ABC is a tangent to the circle at B with $AB = BC$. BP is a diameter.

AP meets the circle at Q. CRS is parallel to BQ.

(a) Prove that:

(1) $\triangle BCR \parallel \triangle SPR$

(5)

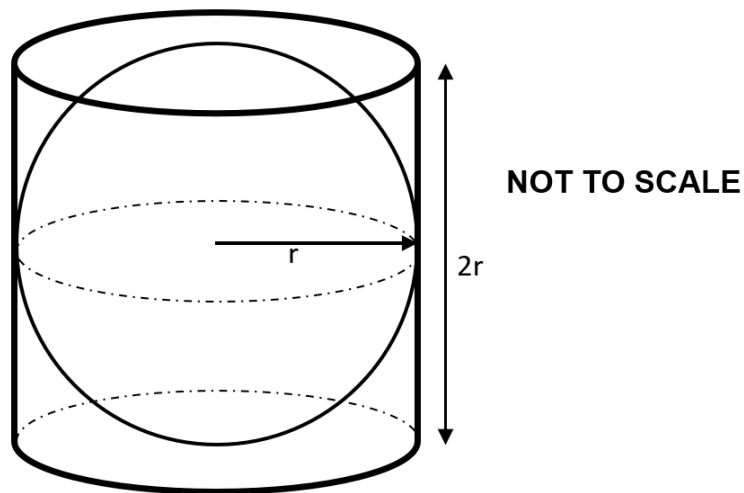
(2) $2RB.SP = SR.CA$

(3)

(b) If $BR : RP = 2 : 3$, calculate $AQ : QP$

(6)

[14]

QUESTION 13

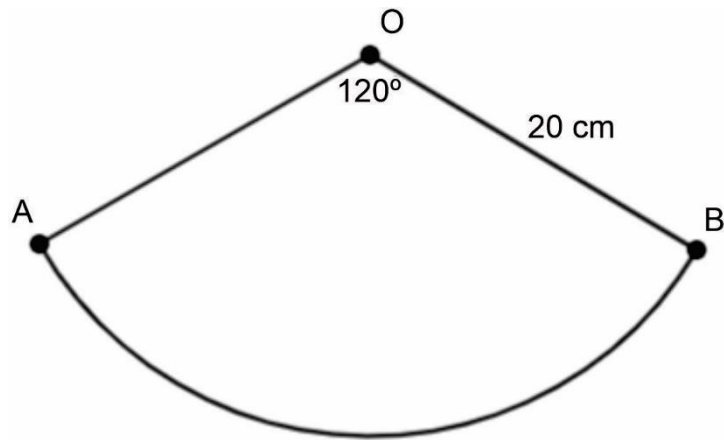
- (a) The sphere of radius r fits exactly inside the cylinder of radius r and vertical height $2r$. Calculate the percentage of the cylinder occupied by the sphere.

[The volume, V , of the sphere with radius r is $V = \frac{4}{3}\pi r^3$.] (4)

- (b) The part of the cylinder not occupied by the sphere is filled with water. If the height of the cylinder is 10 cm, calculate the depth of the water after the sphere is taken out. (4)

QUESTION 14

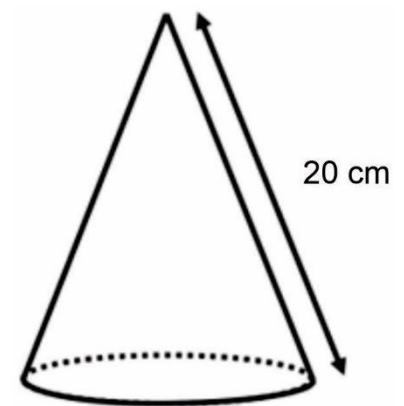
A sector AOB has an angle of 120° and a radius of 20 cm.



- (a) Calculate the area of the sector and show that it rounds to 419 cm^2 . (3)

- (b) The sector radii OA and OB in part (a) are joined to form a cone. The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.

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Calculate the perpendicular height of the cone.

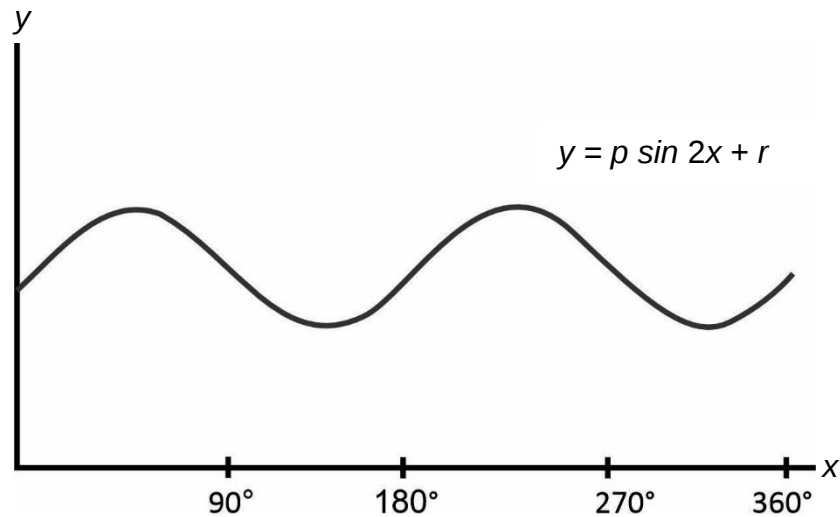
(4)

[7]

QUESTION 15

The function $f(x) = p \sin qx + r$ is defined for $0 \leq x \leq 360^\circ$, where p , q and r are positive constants.

The diagram shows the graph for the specific case where $q = 2$, thus, the graph of $f(x) = p \sin 2x + r$.



(a) In terms of p and r , state the range of f . (2)

(b) If $q = 2$, state the number of solutions of the following equations:

(1) $f(x) = p + r$ (2)

(2) $f(x) = r$ (2)

- (c) If $f(x) = \frac{1}{2}p + r$, what value of q would produce 101 solutions? (2)

[8]

75 marks

Total: 150 marks

ADDITIONAL SPACE (ALL QUESTIONS)

**REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE
ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.**

