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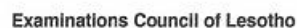
October/November 2020

2 hours 30 minutes

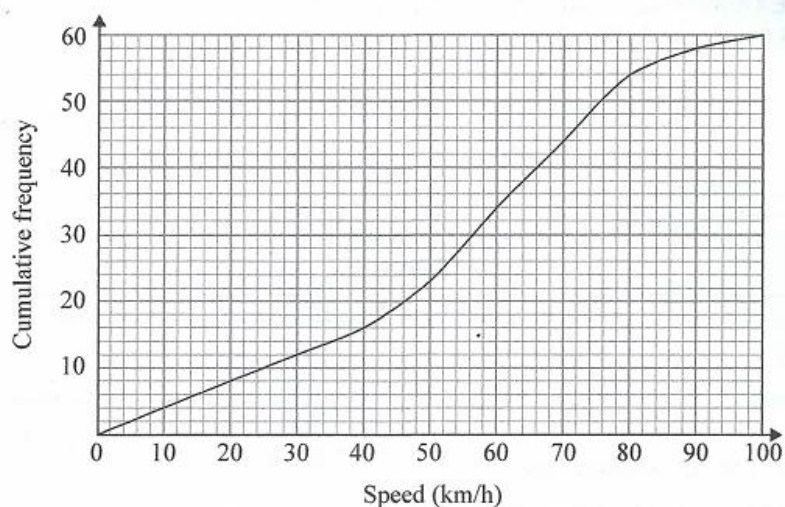
Additional Materials: Electronic Calculator
Geometrical Instruments
Tracing paper (optional)

The number of marks is given in brackets [] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **16** printed pages.



- 1 A traffic department has speed records on 60 cars.
The cumulative frequency curve illustrates the information.



(a) Estimate

(i) the median speed,

Answer (a)(i) km/h [1]

(ii) the inter-quartile range.

Answer (a)(ii) km/h [2]

(b) The speed limit on the road is 80 km/h.

A car is chosen at random, calculate the probability that this car exceeded the speed limit.

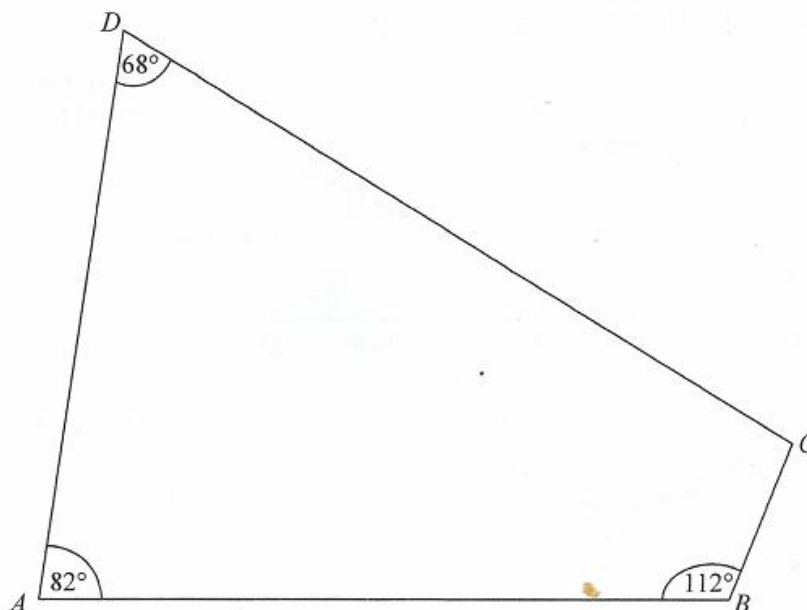
Answer (b) [2]

(c) Use the information from the cumulative frequency curve to complete the table.

Speed (km/h)	$0 < s \leq 10$	$10 < s \leq 20$	$20 < s \leq 30$	$30 < s \leq 40$	$40 < s \leq 50$
Frequency	4	4	4	4	7
Speed (km/h)	$50 < s \leq 60$	$60 < s \leq 70$	$70 < s \leq 80$	$80 < s \leq 90$	$90 < s \leq 100$
Frequency				4	2

[3]

- 2 The diagram shows a quadrilateral $ABCD$.



- (a) Explain why A , B , C and D lie on a circle.

Answer (a)

[1]

- (b) Find, by construction, the point O , equidistant from all the vertices.

[2]

- (c) Find, by accurate construction, the region, inside the quadrilateral, containing the points, P such that

- P lies nearer to CD than DA ,
- P lies nearer to CD than CB .

Shade this region.

[3]

- (d) Describe the locus of a point Q , which is equidistant from AB and BC , if Q lies.

- (i) on the plane $ABCD$,

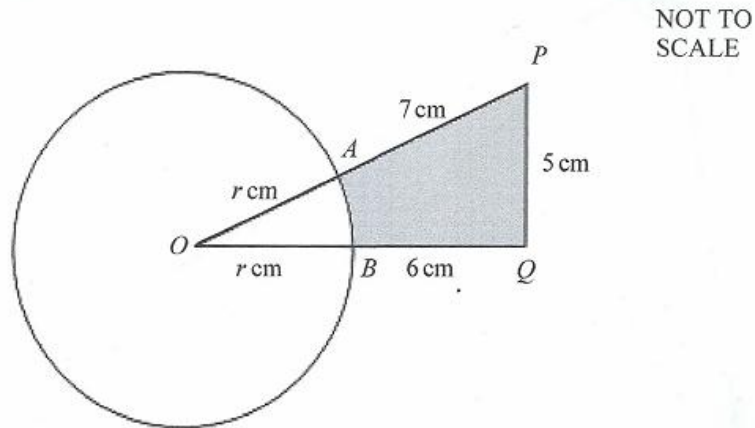
Answer (d)(i) [1]

- (ii) in space.

Answer (d)(ii)

[2]

- 3 The diagram shows a right-angled triangle OPQ and a circle, centre O with radius r cm. The circle cuts OP and OQ at A and B respectively. $AP = 7$ cm, $PQ = 5$ cm, $BQ = 6$ cm and angle $OQP = 90^\circ$.



- (a) Show that $r = 6$ cm.

Answer (a) [3]

- (b) Find the value of $\sin POQ$.

Answer (b) [1]

- (c) Calculate

- (i) the length of major arc AB ,

Answer (c)(i) cm [3]

- (ii) the shaded area.

Answer (c)(ii) cm^2 [4]

4 (a) $f(x) = \frac{1}{x}$

Find:

(i) $f(3)$,

Answer (a)(i) [1]

(ii) $f\left(\frac{k}{4}\right)$, in terms of k ,

Answer (a)(ii) [1]

(iii) k if $f\left(2 - \frac{k}{4}\right) = 2$,

Answer (a)(iii) [3]

(iv) $ff\left(8^k - \frac{k}{5}\right)$, in terms of k .

Answer (a)(iv) [1]

- (b) Another function $g(x)$ is such that:
 $g(192) = 850$, and $g^{-1}(x)$ exists.

Find $g^{-1}g(192)$.

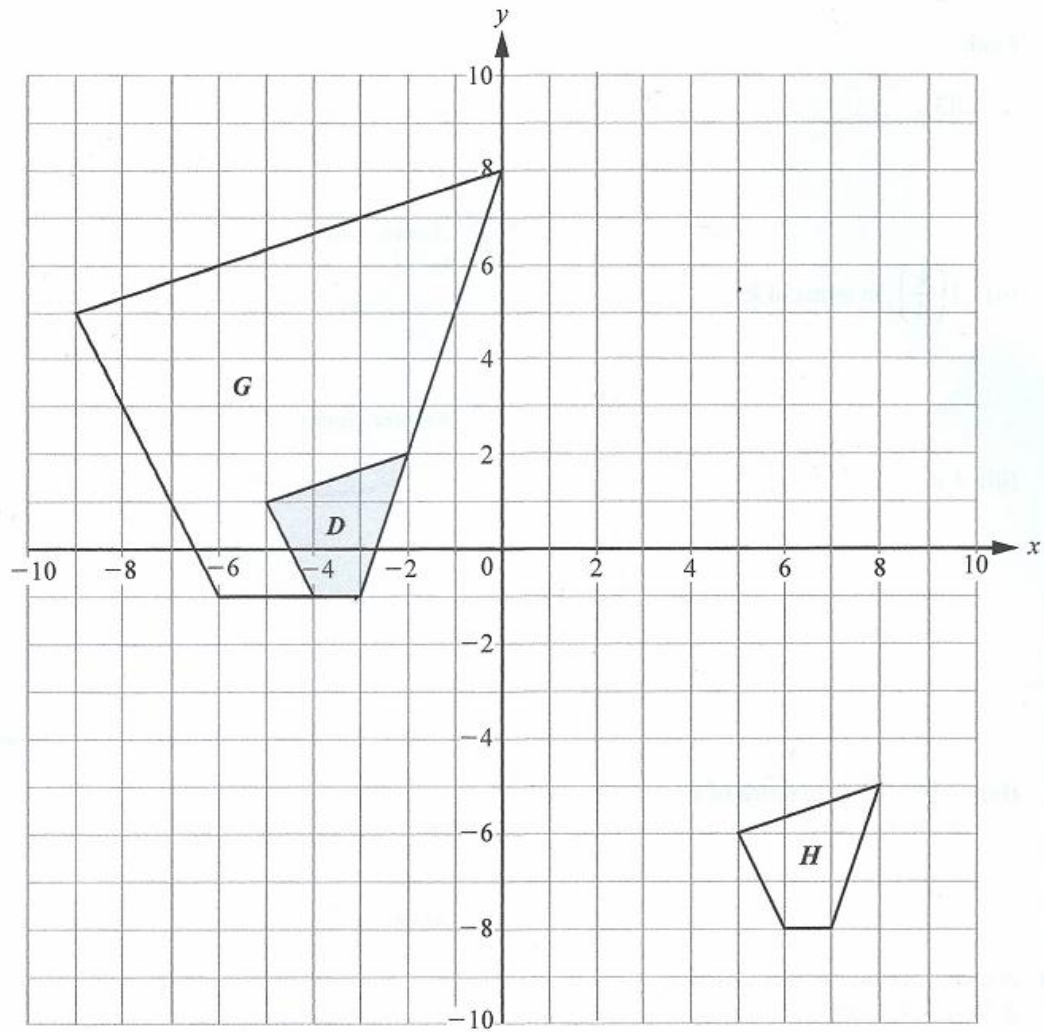
Answer (b) [1]

- (c) Simplify $f(x)f(x) - ff(x)$.

Give your answer as a single fraction, in terms of x .

Answer (c) [2]

- 5 The diagram shows polygons D , G and H .



- (a) Describe fully the **single** transformation that maps

- (i) polygon D onto polygon G ,

Answer (a)(i)
 [3]

- (ii) polygon D onto polygon H .

Answer (a)(ii)
 [2]

(b) On the grid, draw and label the image,

(i) R , of polygon G , after a reflection in the line $x = 0$, [2]

(ii) M , of polygon D , after a stretch factor -1.5 , with $y = -2$ invariant. [2]

6 (a) The point $(1, 1)$ is the midpoint of (a, b) and $(b - 3a, 2a)$.

(i) Show that $a = 0$, and $b = 2$.

Answer (a)(i) [5]

(ii) Find c given that $(7, c)$, $(1, 1)$ and (a, b) lie on the same straight line.

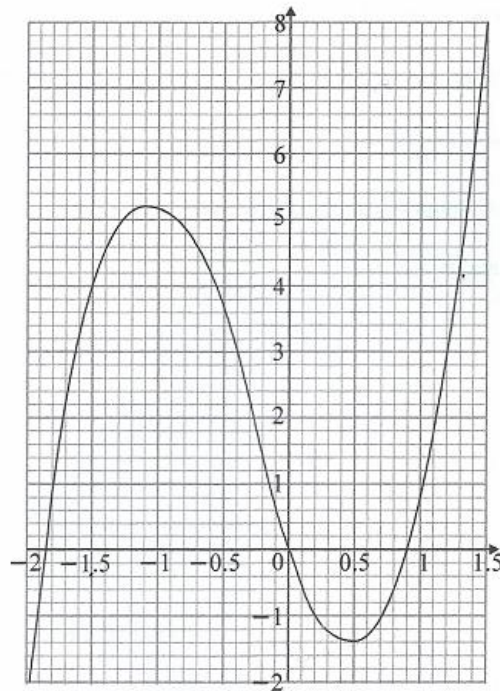
Answer (a)(ii) [3]

(b) A point $(2, t)$ is a distance $2t + 1$ from the point $(1, 0)$.

Calculate the values of t .

Answer (b) [4]

- 7 The diagram shows the graph of $y = f(x)$ for $-2 \leq x \leq 1.5$.



- (a) Using the graph, find;

(i) $f(-1)$

Answer (a)(i) [1]

- (ii) values of x for which $f(x) = 4$.

Answer (a)(ii) $x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- (iii) By drawing tangents appropriately on the graph of $y = f(x)$, find the range of values within which $f(x)$ has exactly three solutions.

Answer (a)(iii) $< f(x) <$ [2]

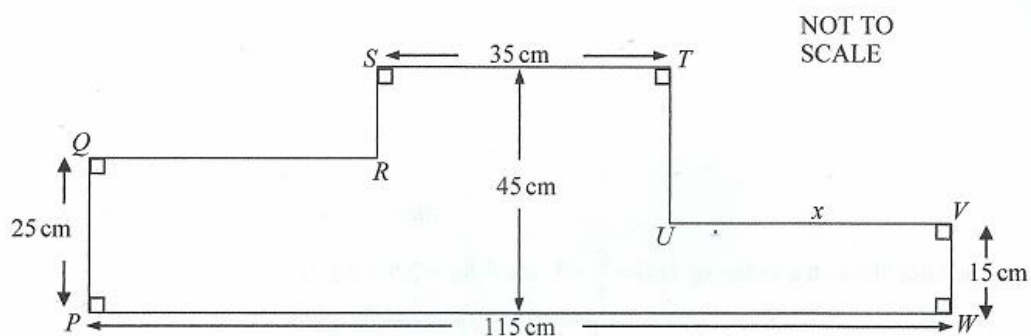
- (b) The table shows the values of $h(x) = \frac{2}{x} + 3$; $x \neq 0$ for $-2.5 \leq x \leq 2.5$.

x	-2	-1	-0.5	0.5	1	1.5
$h(x)$			-1	7		4.3

- (i) Complete the table. [3]
- (ii) On the grid above, draw the graph of $y = h(x)$. [2]
- (iii) Use your graph to solve the equation $h(x) = f(x)$. [2]

- 8 The diagram shows a **cross section** of a machine.

$$QR = UV.$$



- (a) Show that $QR = 40$ cm.

Answer (a) [2]

- (b) Find the perimeter of the cross section.

Answer (b) cm [2]

- (c) (i) Calculate the area of the cross section.

Answer (c)(i) cm^2 [2]

- (ii) This machine is in the form of a prism, 200 cm long.

Find the volume of the machine.

Answer (c)(ii) cm^3 [1]

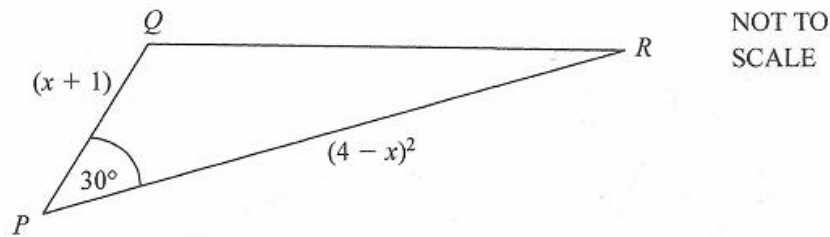
- (iii) The prism is completely filled with some material.

1 **cubic metre** of this material has mass 2 kg.

Calculate the mass of the material used.

Answer (c)(iii) kg [2]

- 9 The diagram shows triangle PQR .
The size of angle $QPR = 30^\circ$, $PQ = (x + 1)\text{m}$ and $PR = (4 - x)^2\text{m}$.



- (a) Show that the area of the triangle QPR is given by $\frac{1}{4}(x^3 - 7x^2 + 8x + 16)$.

Answer (a) [3]

- (b) It is given that $x = 10$.

Find

- (i) the area of PQR ,

Answer (b)(i) m^2 [2]

- (ii) the length of QR .

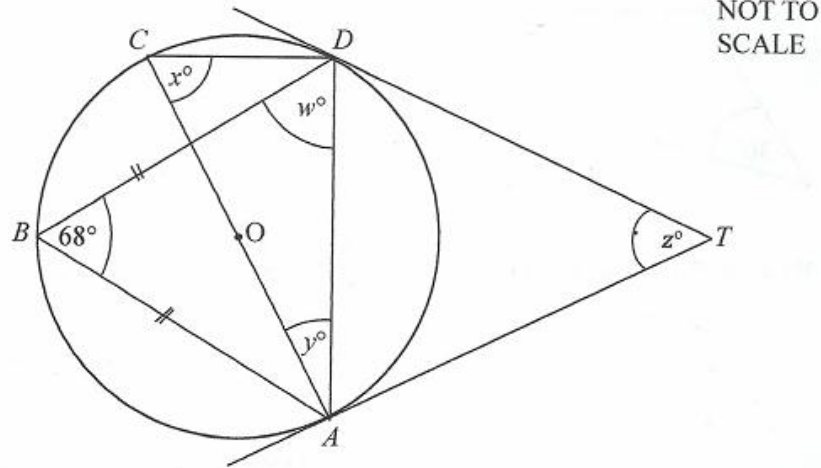
Answer (b)(ii) m [4]

- (c) A vertical pole is placed at Q .
The height of the pole is 8 m.
A bird is at the top of the pole and sees a prey along PR .

Find PT , the maximum angle of depression of the prey from the bird.

Answer (c) [4]

- 10 In the diagram AOC is the diameter of circle $ABCD$.
 AT and DT are tangents to the circle.
 $BD = BA$ and angle $DBA = 68^\circ$.



Find the value of

(a) w ,

Answer (a) [2]

(b) x ,

Answer (b) [1]

(c) y ,

Answer (c) [1]

(d) z .

Answer (d) [2]

- 11 (a) The cash price of a mobile set is 10% less than the hire purchase price.
A customer buys a mobile set on a hire purchase and pays a deposit of M300 followed by 12 monthly instalments of M150.

Calculate

- (i) the cash price,

Answer (a)(i) M [3]

- (ii) the rate of interest charged on the cash price to determine the hire purchase price.

Answer (a)(ii) % [2]

- (b) A bus travelling at an average speed of 60 km/h left a bus stop at 8.15 am.
A taxi left the bus stop at 9.00 am and overtook the bus at 10.45 am.

- (i) How much time, in hours, did the bus take before it was overtaken.

Answer (b)(i) hrs [1]

- (ii) Find the average speed of the taxi.

Answer (b)(ii) km/h [4]

- 12 A farmer had 540 bags of wet sorghum each having a mass of 96 kg.
After the sorghum was left to dry, it is found that mass of dried sorghum : mass of wet sorghum = 15 : 16.

(a) Calculate the total mass lost during drying.

Answer (a) kg [3]

- (b) A trader bought the 540 bags of dried sorghum at M168.75 per bag.
He then repacked them into 75 kg bags.
He transported them to a market in loads of up to 162 bags per trip.

(i) Find the minimum number of trips required to transport all the sorghum.

Answer (b)(i) [3]

(ii) The trader paid M250 per trip and sold all the bags of dried sorghum to make a profit of 26%.

Calculate the selling price of each bag.

Answer (b)(ii) M [3]

- 13 The table shows the number of coffee tins of sizes 125 g, 250 g and 500 g delivered to shops A, B and C.

	Coffee packets		
	125 g	250 g	500 g
Shop A	50	100	300
Shop B	60	150	40
Shop C	80	200	70

(a) Find

- (i) the total number of coffee tins delivered to shop B.

Answer (a)(i) [1]

- (ii) the total mass, in kg, of coffee tins delivered to shop C.

Answer (a)(ii) kg [2]

- (b) The cost prices of 125 g, 250 g and 500 g are M16, M34 and M60 respectively.

Write a column matrix to represent the prices of the tins.

Answer (b) [1]

- (c) Find the matrix that represents the total cost of the tins to each shop.

Answer (c) [3]

- 14 The table shows the time, t minutes, taken by 60 students to complete a mathematics test.

Time t . (minutes)	$0 < t \leq 10$	$10 < t \leq 15$	$15 < t \leq 30$
Frequency	17	23	20

- (a) Calculate an estimate of the mean.

Answer (a) [3]

- (b) On a histogram, the frequency density for $0 < t \leq 10$ is 1.7 cm.

Calculate the frequency density for $10 < t \leq 15$.

Answer (b) [2]