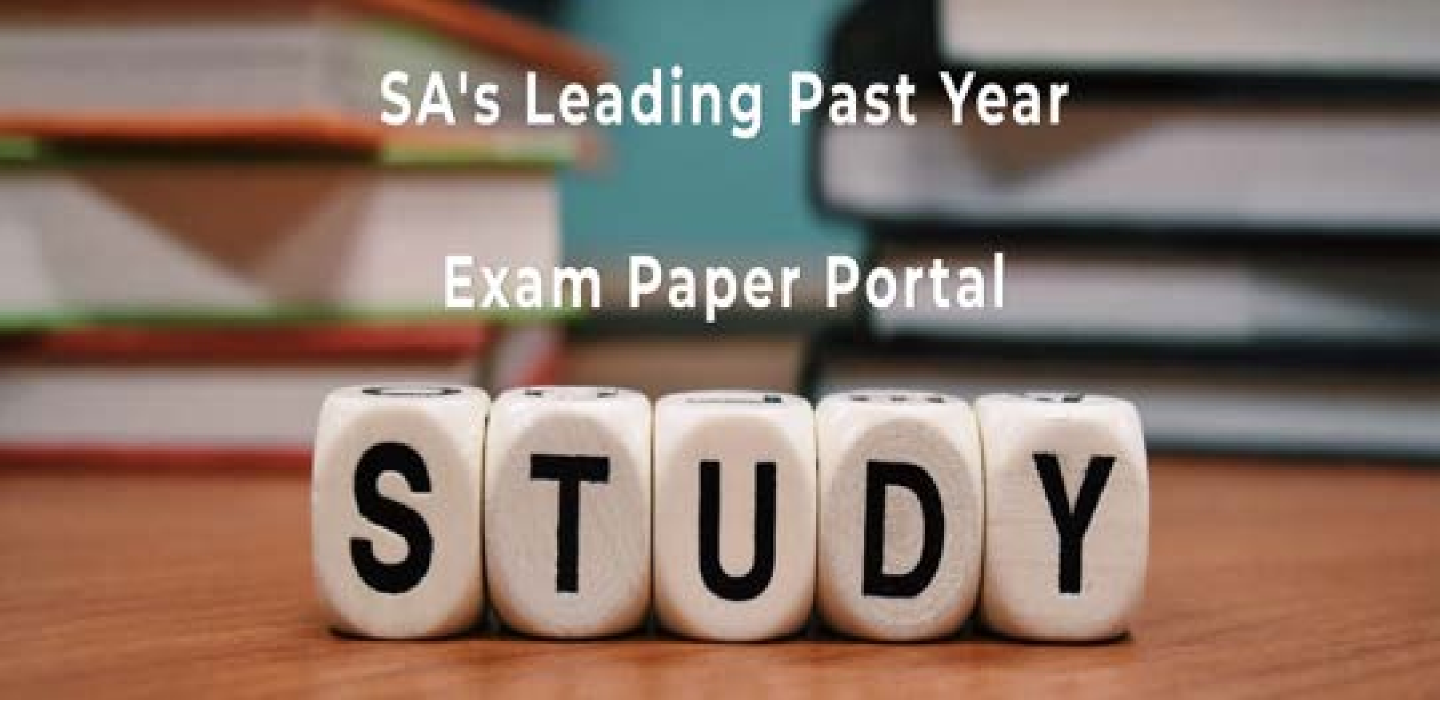
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basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P3

NOVEMBER 2011

MARKS: 100

TIME: 2 hours

This question paper consists of 9 pages, 3 diagram sheets and 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.

2. Answer ALL the questions.

3. Clearly show ALL calculations, diagrams, graphs, et cetera, that you have used in determining your answers.

4. Answers only will not necessarily be awarded full marks.

5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

6. If necessary, round your answers off to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to scale.

8. THREE diagram sheets for answering QUESTION 7.1, QUESTION 8.1, QUESTION 8.2, QUESTION 9, QUESTION 10 and QUESTION 11 are attached at the end of this question paper. Write your centre number and examination number on these sheets in the spaces provided and insert them inside the back cover of your ANSWER BOOK.

9. An information sheet, with formulae, is included at the end of the question paper.

10. Number the answers correctly according to the numbering system used in this question paper.

11. Write legibly and present your work neatly.

QUESTION 1

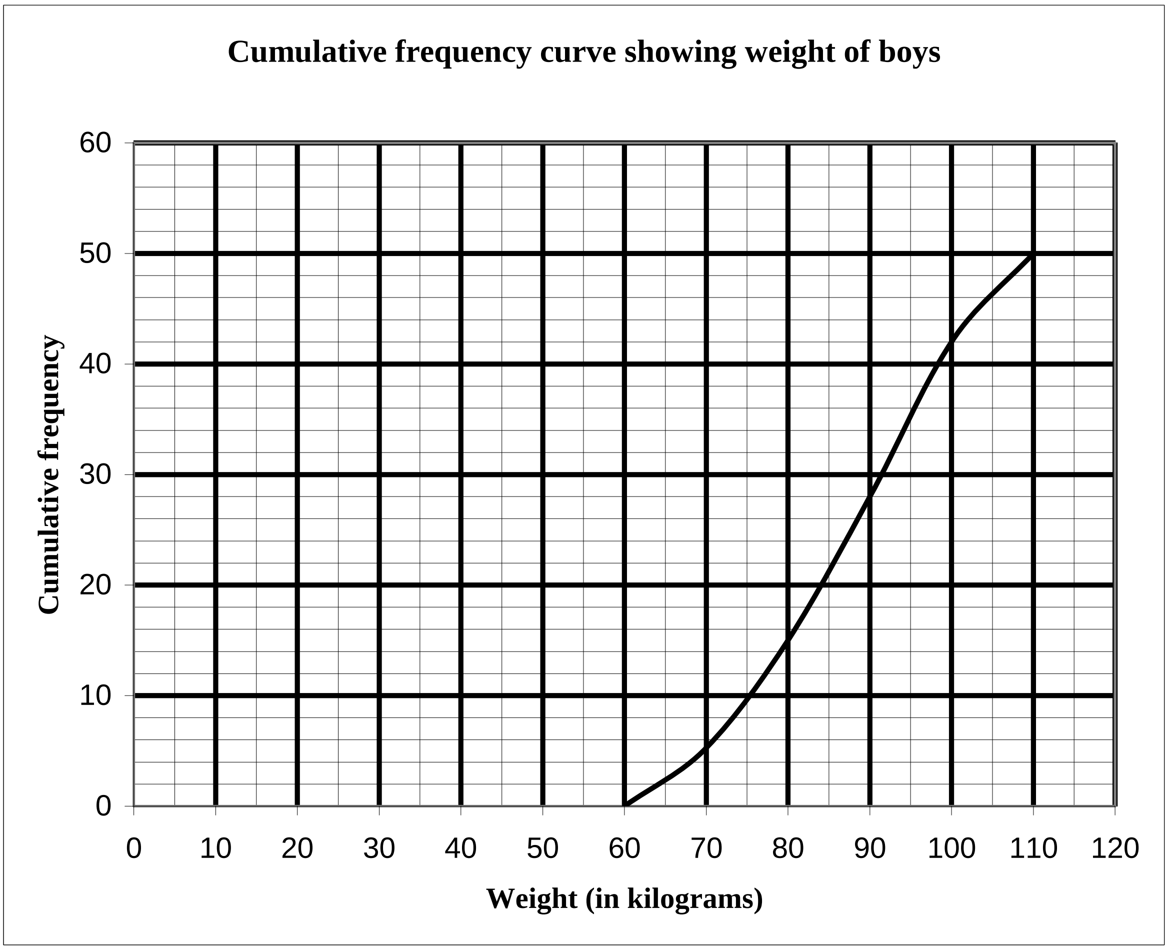
Consider the following recursive formula: $T_{k+1} = T_k - 2\,;\; k \geq 1\,;\; T_1 = 12$

1.1 Write down the first FOUR terms of the sequence. (3)

1.2 How many terms of the above sequence must be added to give a sum of 0? (3)
[6]

QUESTION 2

The weights of a random sample of boys in Grade 11 were recorded. The cumulative frequency graph (ogive) represents the recorded weights.



2.1 How many of the boys weighed between 90 and 100 kilograms? (1)

2.2 Estimate the median weight of the boys. (1)

2.3 If there were 250 boys in Grade 11, estimate how many of them would weigh less than 80 kilograms? (2)

2.4 It was suggested that the first 50 boys in Grade 11 to arrive at school on that day, be selected as a sample. Explain why this would not be a random sample. (1)
[5]

QUESTION 3

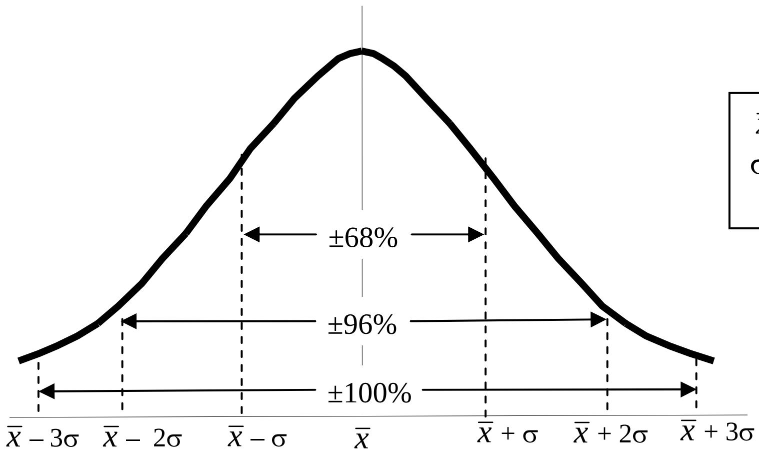
Let A and B be two events in a sample space. Suppose that P(A) = 0,4; P(A or B) = 0,7 and P(B) = k.

3.1 For what value of k are A and B mutually exclusive? (2)

3.2 For what value of k are A and B independent? (4)
[6]

QUESTION 4

The time taken for a pizza outlet to deliver to a customer is recorded. The data is found to be normally distributed with a mean time of 24 minutes and a standard deviation of 3 minutes.



$\bar{x}$ = mean
σ = standard deviation

Answer the following questions with reference to the information provided in the graph.

4.1 What percentage of pizzas are delivered between 21 and 24 minutes? (2)

4.2 What percentage of pizzas are delivered between 15 and 27 minutes? (3)

4.3 The outlet advertises that they will not charge for a pizza that takes longer than a certain time to deliver. If they want to give away no more than 2% of all deliveries, how many minutes should they allow for delivery? (3)
[8]

QUESTION 5

The digits 0, 1, 2, 3, 4, 5 and 6 are used to make 3 digit codes.

5.1 How many unique codes are possible if digits can be repeated? (2)

5.2 How many unique codes are possible if the digits cannot be repeated? (2)

5.3 In the case where digits may be repeated, how many codes are numbers that are greater than 300 and exactly divisible by 5? (3)
[7]

QUESTION 6

Complaints about a restaurant fell into three main categories: the menu (M), the food (F) and the service (S). In total 173 complaints were received in a certain month. The complaints were as follows:

- 110 complained about the menu.
- 55 complained about the food.
- 67 complained about the service.
- 20 complained about the menu and the food, but not the service.
- 11 complained about the menu and the service, but not the food.
- 16 complained about the food and the service, but not the menu.
- The number who complained about all three is unknown.

6.1 Draw a Venn diagram to illustrate the above information. (6)

6.2 Determine the number of people who complained about ALL THREE categories. (3)

6.3 Determine the probability that a complaint selected at random from those received, complained about AT LEAST TWO of the categories (that is. menu, food and service). (3)
[12]

QUESTION 7

The outdoor temperature, in °C, at noon on ten days and the number of units of electricity used to heat a house on each of those days, are shown in the table below.

Noon temperature (in °C)	7	11	9	2	4	7	0	10	5	3
Units of electricity used	32	20	27	37	32	28	41	23	33	36

7.1 Draw a scatter graph that shows this information on the grid provided on DIAGRAM SHEET 1. (3)

7.2 Determine the equation of the least squares regression line. (4)

7.3 Determine the correlation coefficient. (2)

7.4 What can we conclude about the relationship between the noon temperature and the number of units of electricity used for heating? (2)

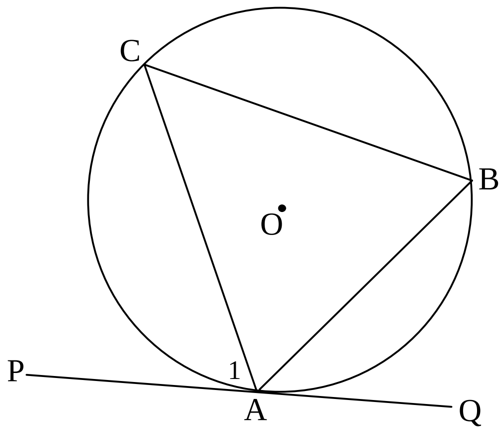
7.5 Estimate the number of units of electricity that was used to heat a house on a day when the outdoor temperature at noon was 8 °C. (2)
[13]

In the next FOUR questions, ensure you give reasons for each statement you make.

QUESTION 8

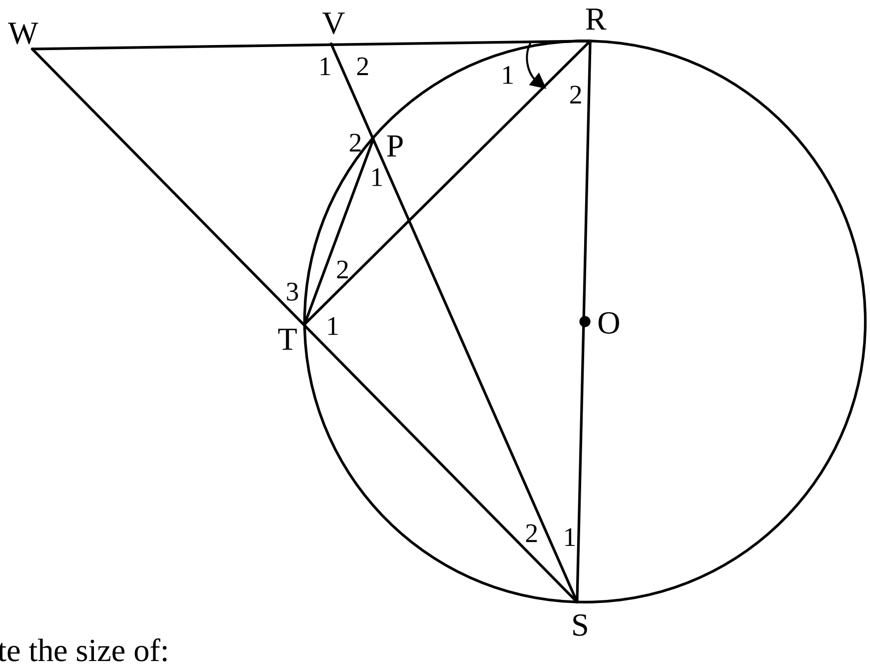
8.1 In the diagram below, O is the centre of the circle. PQ is a tangent to the circle at A. B and C are points on the circumference of the circle. AB, AC and BC are joined.

Prove the theorem that states $C\hat{A}P = A\hat{B}C$.



(5)

8.2 RS is a diameter of the circle with centre O. Chord ST is produced to W. Chord SP produced meets the tangent RW at V. $\hat{R}_1 = 50°$.



Calculate the size of:

8.2.1 $W\hat{R}S$ (1)

8.2.2 $\hat{W}$ (2)

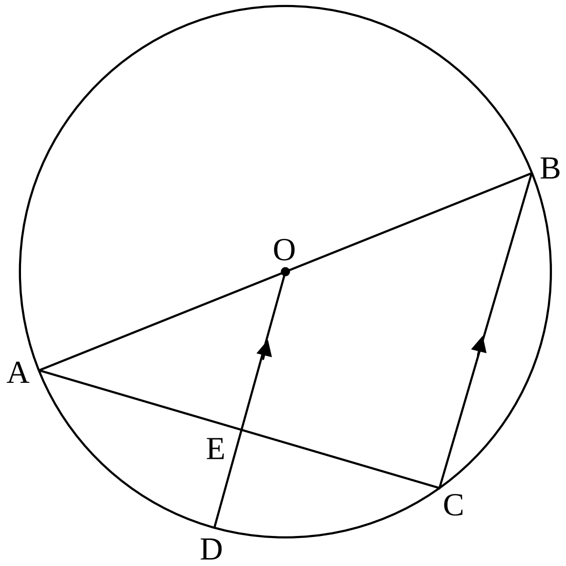
8.2.3 $\hat{P}_1$ (3)

8.2.4 Prove that $\hat{V}_1 = P\hat{T}S$. (4)

[15]

QUESTION 9

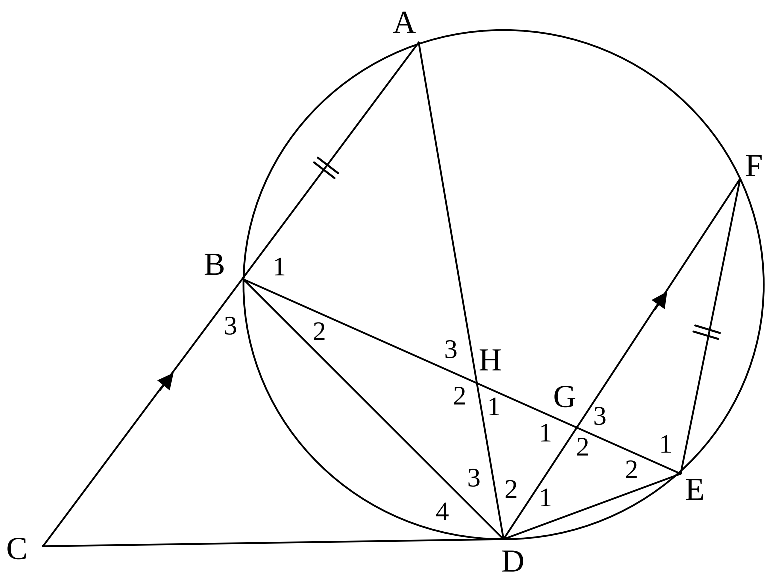
AB is a diameter of the circle ABCD. OD is drawn parallel to BC and meets AC in E.



If the radius is 10 cm and AC = 16 cm, calculate the length of ED. **[5]**

QUESTION 10

CD is a tangent to circle ABDEF at D. Chord AB is produced to C. Chord BE cuts chord AD in H and chord FD in G. AC || FD and FE = AB. Let $\hat{D}_4 = x$ and $\hat{D}_1 = y$.



10.1 Determine THREE other angles that are each equal to x. (6)

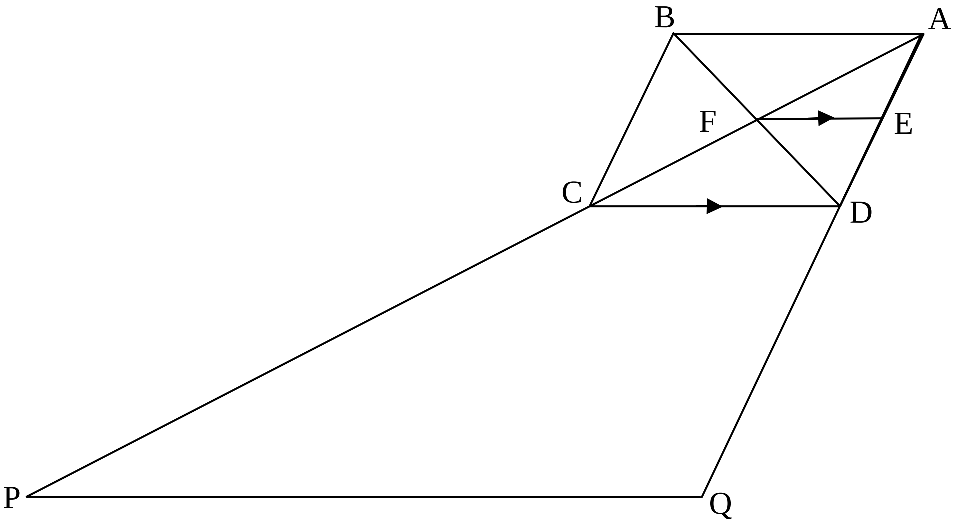
10.2 Prove that $\Delta BHD \parallel\!| \Delta FED$. (5)

10.3 Hence, or otherwise, prove that AB.BD = FD.BH. (2)

[13]

QUESTION 11

ABCD is a parallelogram with diagonals intersecting at F. FE is drawn parallel to CD. AC is produced to P such that PC = 2AC and AD is produced to Q such that DQ = 2AD.



11.1 Show that E is the midpoint of AD. (2)

11.2 Prove PQ || FE. (3)

11.3 If PQ is 60 cm, calculate the length of FE. (5)
[10]

TOTAL: 100

CENTRE NUMBER:

EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTION 7.1

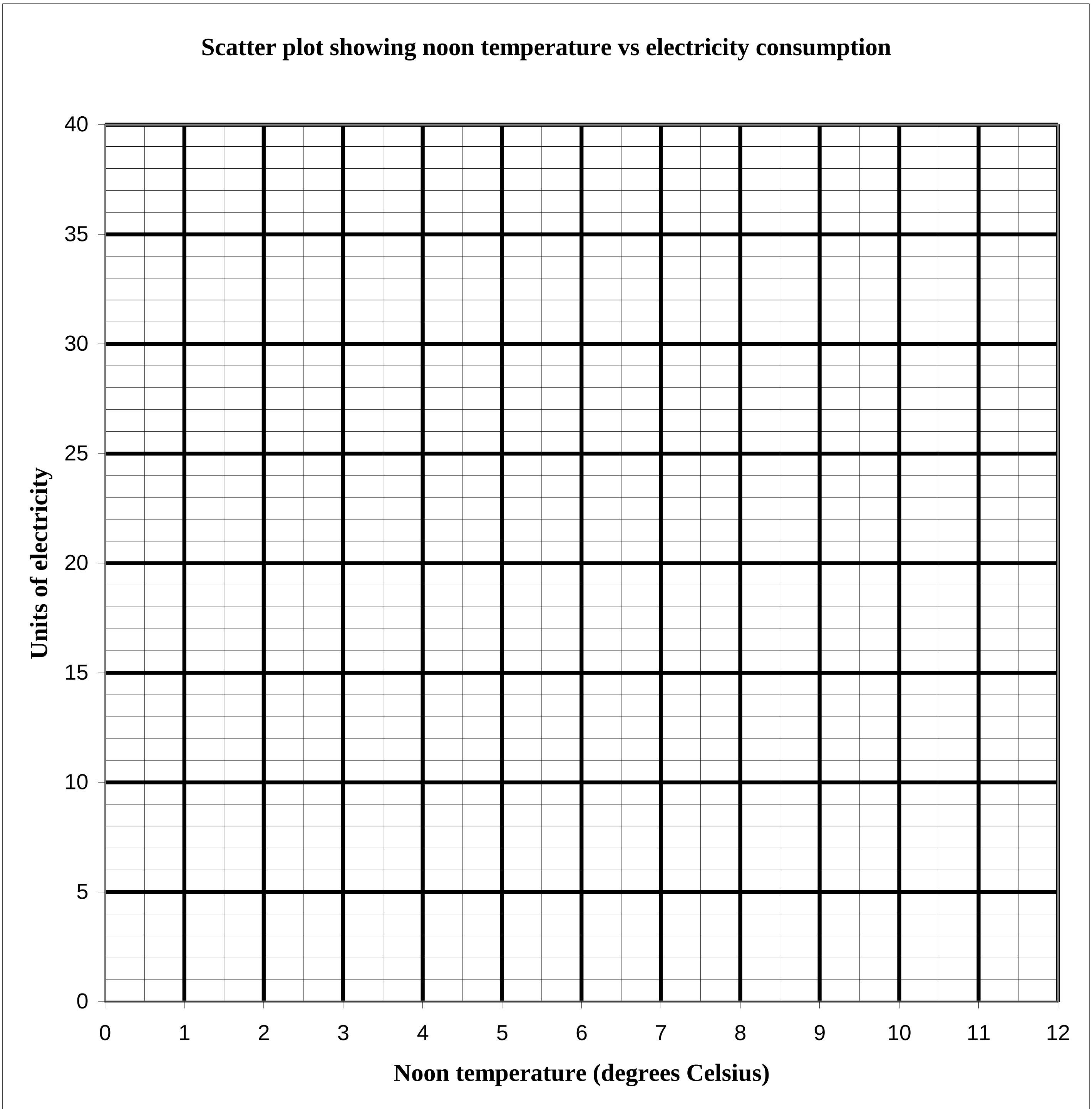


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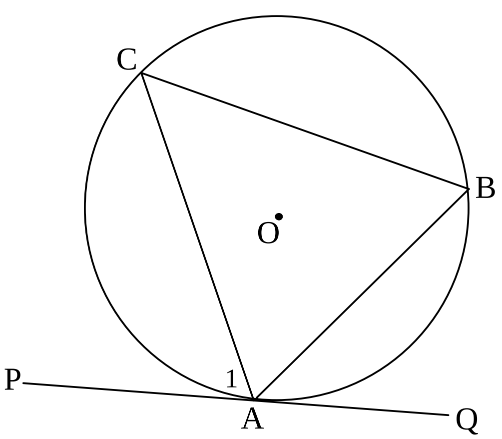
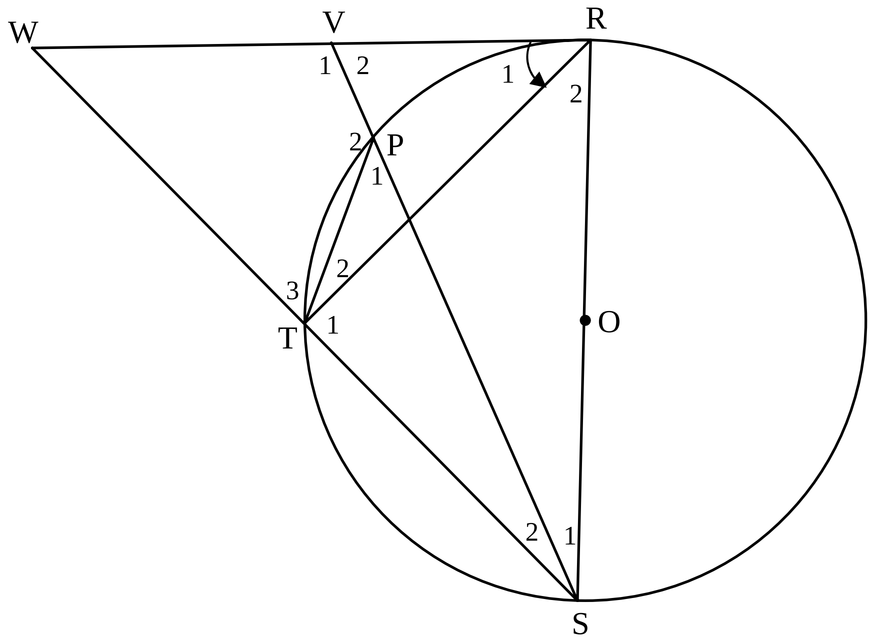
DIAGRAM SHEET 2

QUESTION 8.1



QUESTION 8.2



QUESTION 9

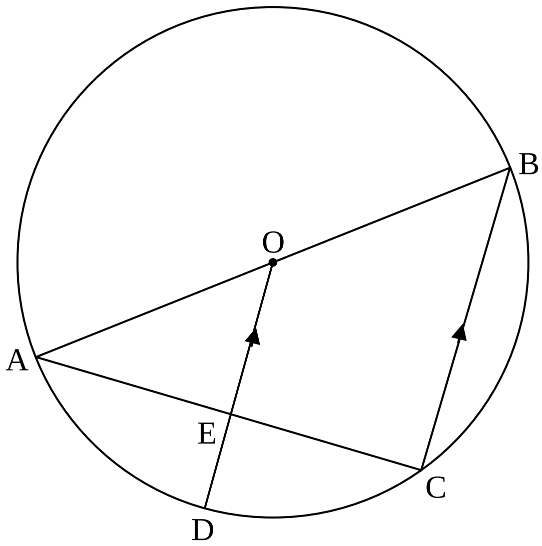


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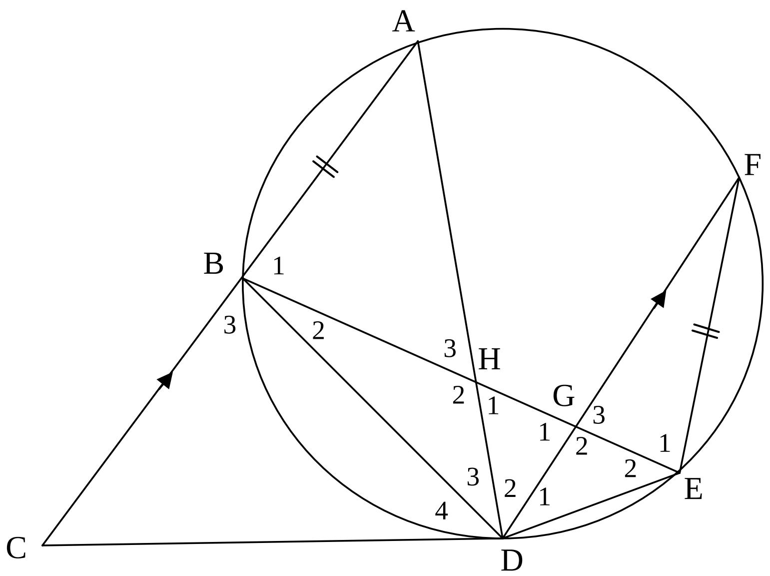
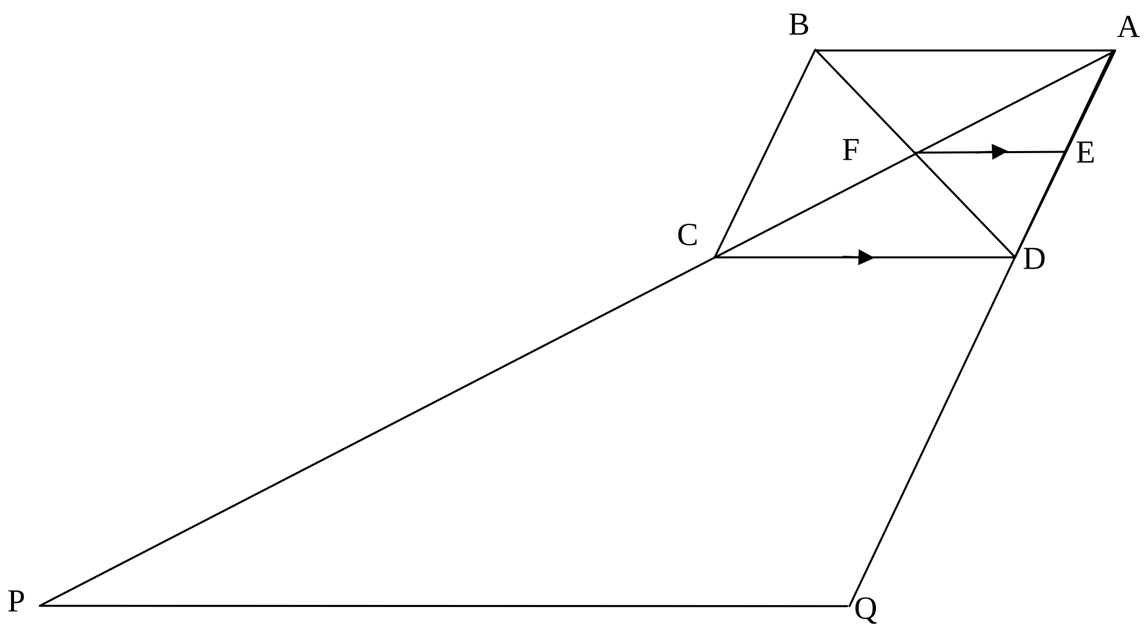
DIAGRAM SHEET 3

QUESTION 10



QUESTION 11



INFORMATION SHEET: MATHEMATICS
INLIGTINGSBLAD: WISKUNDE

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad A = P(1-ni)$ $\quad A = P(1-i)^n$ $\quad A = P(1+i)^n$

$\sum_{i=1}^{n} 1 = n$ $\quad \sum_{i=1}^{n} i = \frac{n(n+1)}{2}$ $\quad T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}\left(2a + (n-1)d\right)$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a\left(r^n - 1\right)}{r-1}$ **;** $r \neq 1$ $\quad S_\infty = \frac{a}{1-r}$ **;** $-1 < r < 1$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $\quad P = \frac{x[1-(1+i)^{-n}]}{i}$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad \mathrm{M}\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad area\ \Delta ABC = \frac{1}{2} ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$ $\quad \sin 2\alpha = 2\sin\alpha.\cos\alpha$

$(x ; y) \to (x\cos\theta + y\sin\theta ; y\cos\theta - x\sin\theta)$ $\quad (x ; y) \to (x\cos\theta - y\sin\theta ; y\cos\theta + x\sin\theta)$

$\bar{x} = \frac{\sum fx}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$