Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sport Ontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko

NORTH WEST PROVINCE

GRADE 12

MATHEMATICS P2

MID-YEAR EXAMINATION 2018

MARKS: 150
TIME: 3 HOURS

This question paper consists of 14 pages 3 diagram sheet and a formula sheet.

NW/JUNE/MATH/ EMIS/6*******

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 9 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining the answers.
3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
4. Answer only will not necessarily be awarded full marks.
5. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. Number the answers correctly according to the numbering system used in this question paper.
8. diagram sheets and an information sheet with formulae are included at the end of the question paper for your use.
9. It is in your own interest to write legibly and to present the work neatly.

QUESTION 1

1.1 The table below shows data of the ages of staff in a school.

Age (A)	**Frequency**	**Cumulative Frequency**
$25 < A \leq 30$	2	2
$30 < A \leq 35$	8	10
$35 < A \leq 40$	4	14
$40 < A \leq 45$	5	19
$45 < A \leq 50$	11	30
$50 < A \leq 55$	19	49
$55 < A \leq 60$	20	69
$60 < A \leq 65$	6	75

1.1.1 Use the table above to draw a cumulative frequency graph on the set of axes provided to represent the data in the table. (4)

1.1.2 Use your cumulative frequency graph to find an estimate for the median age. (2)

1.1.3 Use your cumulative frequency graph to find an estimate for the percentage of teachers older than 50 years. (4)

1.1.4 Use your cumulative frequency graph to draw a box and whisker diagram for the given data. Use the number line provided. (3)

1.1.5 Comment on the skewness of the data. (1)

1.2 The marks (in percentage) of 7 learners who wrote the Mathematics Olympiad in a school are:

68 12 44 71 27 86 52

1.2.1 Determine the mean of marks of learners. (2)

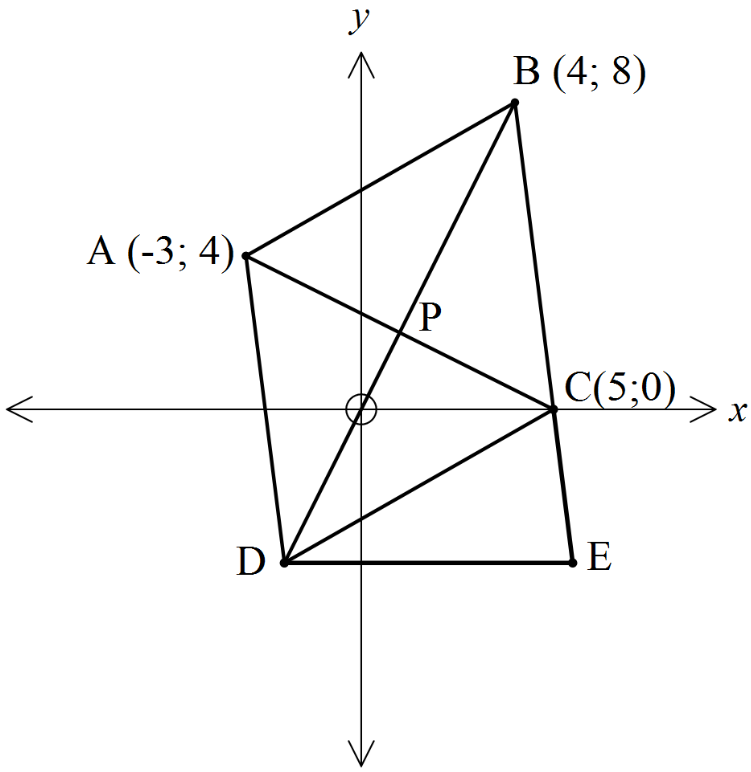
1.2.2 Calculate the standard deviation for the marks of learners (2)

1.2.3 How many learners were within ONE standard deviation (2)

[20]

QUESTION 2

In the diagram below, A(– 3;4), B(4;8), C(5;0) and D are the vertices of a parallelogram. BC is extended to E to meet DE which is parallel to the *x*-axis.



2.1 Determine the equation of line BE. (4)

2.2 Determine the coordinates of P, where P is the point of intersection of the diagonals of ABCD. (2)

2.3 Determine the coordinates of D. (2)

2.4 Prove that ABCD is a rhombus. (3)

2.5 Calculate the size of $A\hat{C}B$. (5)

2.6 Calculate the length of DE. (3)

2.7 Calculate the area of ΔABC. (3)

[22]

QUESTION 3

3.1 Simplify the following to one trigonometric ratio:

$$\frac{\cos(90^\circ + \text{B}).\sin(450^\circ + \text{B})}{\cos(180^\circ + \text{B}).\cos(\text{B} - 180^\circ)}$$ (5)

3.2 Evaluate, without using a calculator:

$$\frac{3\tan 123^\circ.\cos 417^\circ}{\cos 147^\circ.\sin 270^\circ}$$ (6)

3.3 If $\cos 23^\circ = a$. Express, the aid of the sketch, the following in terms of *a*.

3.3.1 $\tan 23^\circ$ (3)

3.3.2 $\sin 46^\circ$ (3)

3.3.3 $\cos 44^\circ$ (3)

[20]

QUESTION 4

4.1 Determine the values of the following, without using a calculator:

4.1.1 $\sin 105^\circ$ (4)

4.1.2 $\cos 69^\circ.\cos 9^\circ + \cos 81^\circ.\cos 21^\circ$ (4)

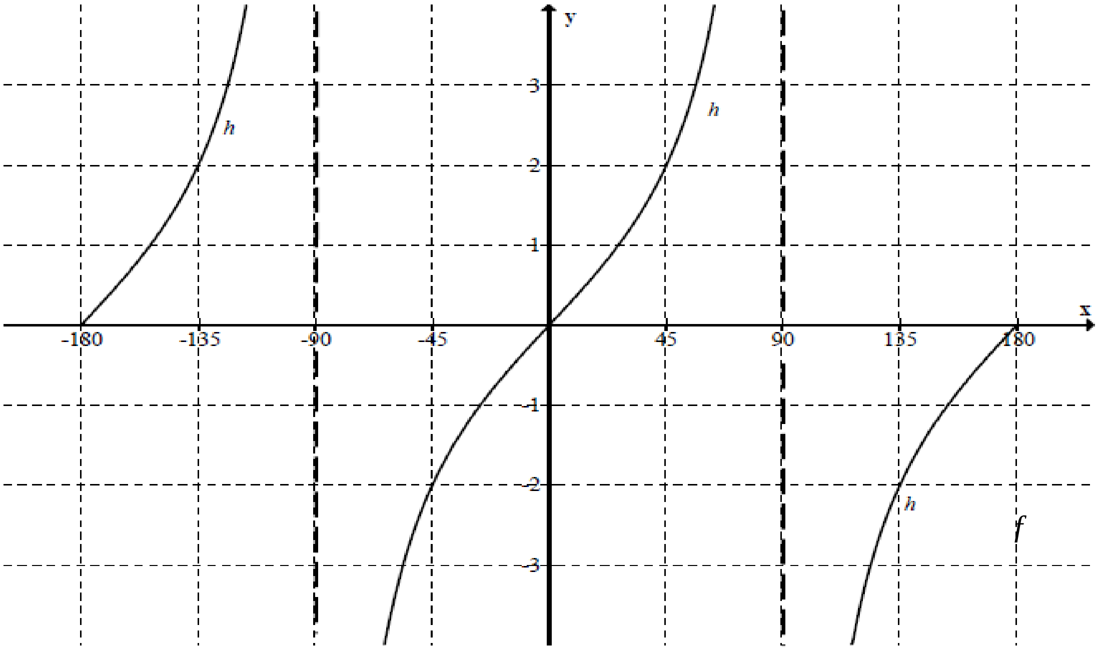
4.2 Prove that: $\dfrac{\sin 2x - \cos x}{1 - \cos 2x - \sin x} = \dfrac{\cos x}{\sin x}$ (5)

4.3 Solve for *x*: $2\cos 2x + 1 = 0$; where $x \in [-180^\circ ; 0^\circ]$ (6)

[19]

QUESTION 5

The graph of $h(x) = a\tan x$ for $x \in [-180^\circ; 180^\circ]$, is sketched below.



5.1 Determine the value of *a*. (2)

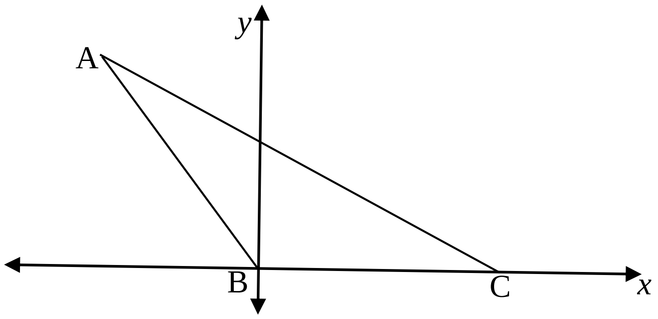
5.2 If $f(x) = \cos(x + 45^\circ)$, sketch the graph of f for $x \in [-180^\circ; 180^\circ]$, on the diagram provided on the diagram sheet. (4)

5.3 How many solutions does the equation $f(x) = h(x)$ have in the domain $[-180^\circ; 180^\circ]$? (1)

[7]

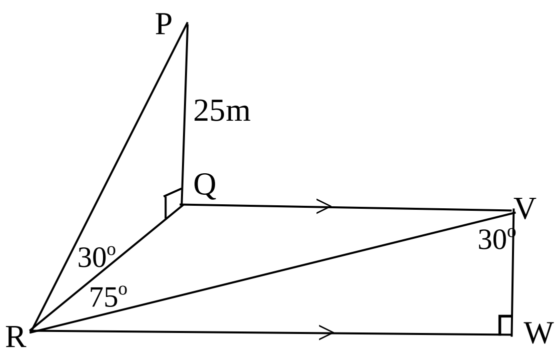
QUESTION 6

6.1 The diagram below shows ΔABC with $\hat{B} > 90^\circ$.



Use the diagram to prove that: $\dfrac{\sin B}{b} = \dfrac{\sin C}{c}$ (6)

6.2 The figure below shows the boundaries of a sports field QRWV. QV || RW and VW $\perp$ RW. PQ is a vertical pole for the floodlight. $P\hat{R}Q = R\hat{V}W = 30^\circ$, $Q\hat{R}V = 75^\circ$ and PQ = 25m.



6.2.1 Determine the size of $R\hat{Q}V$. (3)

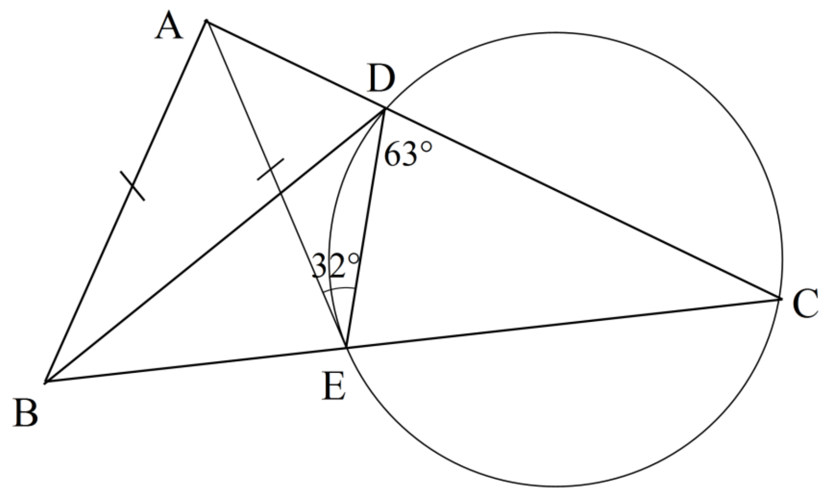
6.2.2 Prove that VR = $25\sqrt{2}$ m. (4)

6.2.3 Calculate the area of ΔQRV, to the nearest integer. (3)

[16]

QUESTION 7

7.1 CD and CE are produced to A and B respectively so that AE is a tangent to the circle and AB = AE. $A\hat{E}D = 32°$ and $C\hat{D}E = 63°$.

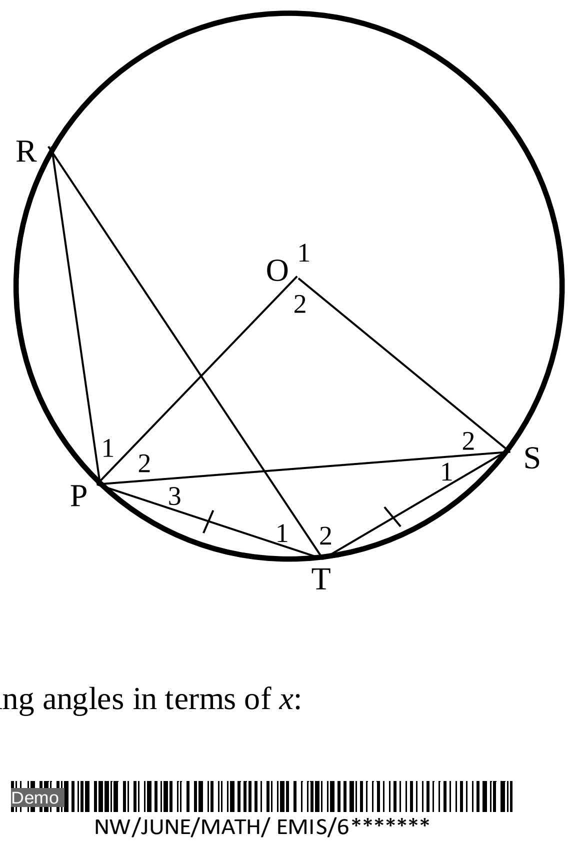


Calculate, giving reasons, the size of

7.1.1 $\hat{C}$ (2)

7.1.2 $A\hat{B}E$ (3)

7.2 In the figure below, O is the centre of the circle passing through R, P, T and S.
PT = TS and $\hat{O}_2 = 2x$



Express the following angles in terms of x:

7.2.1 $\hat{P}_2$ (3)

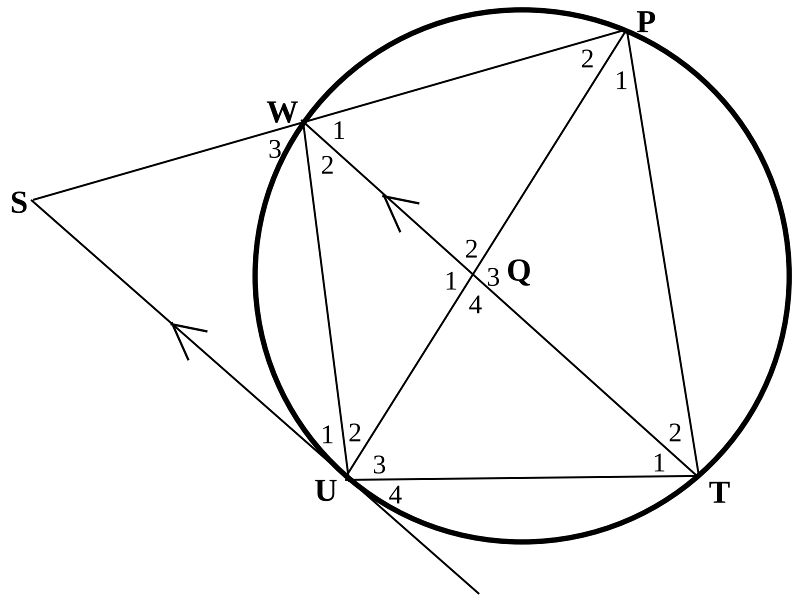
7.2.2 $P\hat{T}S$ (3)

7.2.3 $\hat{R}$ (4)

[15]

QUESTION 8

In the diagram below, PWUT is a cyclic quadrilateral with WU = TU and US || TW.



8.1 If $\hat{U}_1 = x$, determine with reasons FOUR other angles each equal to x. (7)

8.2 Prove that US is a tangent to circle PWUT. (2)

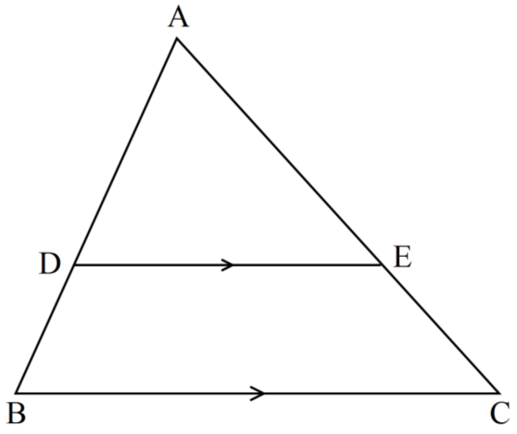
8.3 Prove that ΔUWS ||| ΔPTU (4)

8.4 If PW = 2cm; PS = 10cm and QU = 5cm, calculate the length of PQ. (4)

[17]

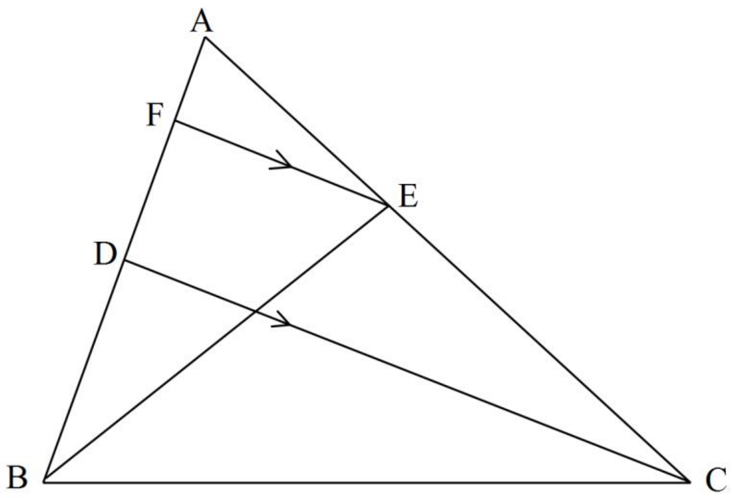
QUESTION 9

9.1 Given below, ΔABC with DE || BC



Prove that: $\frac{AD}{DB} = \frac{AE}{EC}$ (6)

9.2 In ΔABC, D is the midpoint of AB, CD || EF and $\frac{AE}{EC} = \frac{2}{3}$.



9.2.1 Determine, with reasons, the value of $\frac{AF}{FB}$. (3)

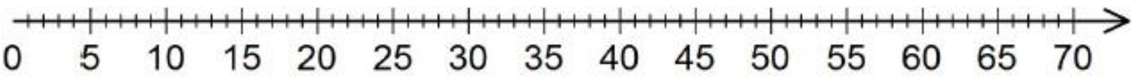
9.2.2 Find the value of $\frac{\text{Area } \Delta BCE}{\text{Area } \Delta FEA}$ (5)

[14]
TOTAL:150

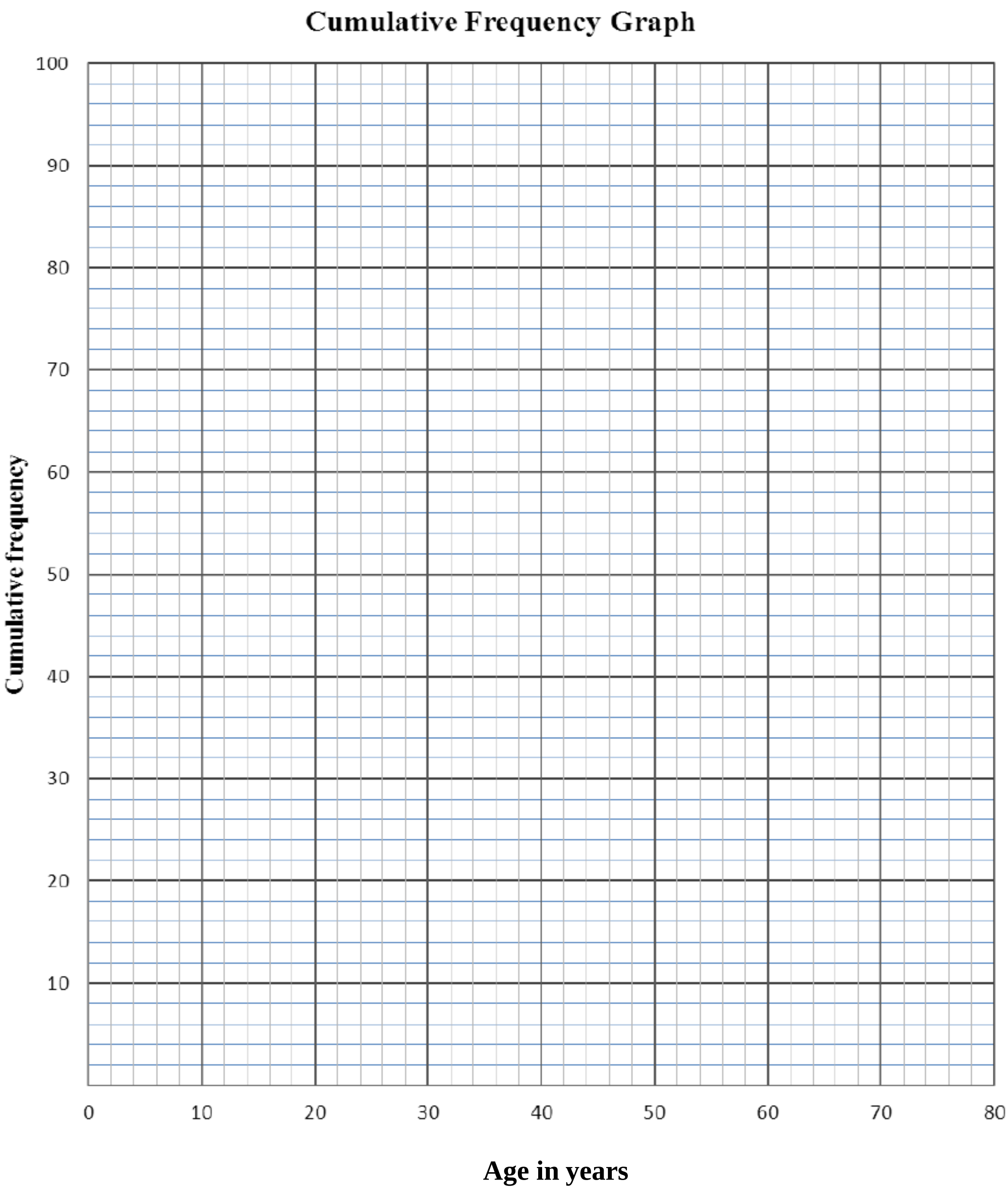
DIAGRAMSHEET

NAME:…………………………………….. **CLASS:…………..**

QUESTION 1.1



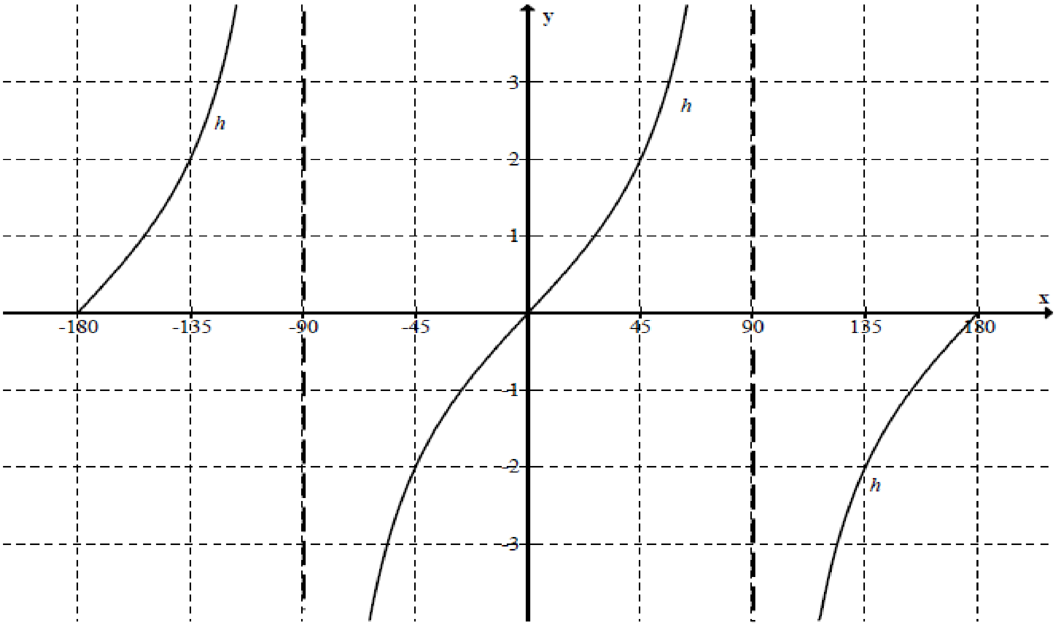
QUESTION 1.4



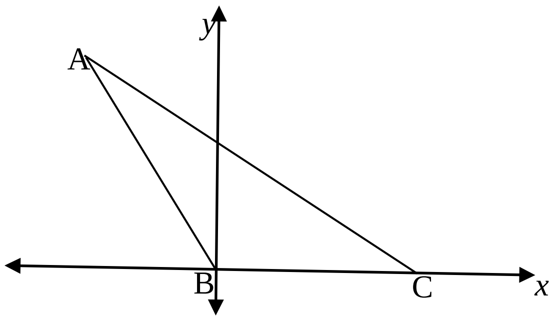
DIAGRAMSHEET

NAME:…………………………………….. **CLASS:…………..**

QUESTION 5

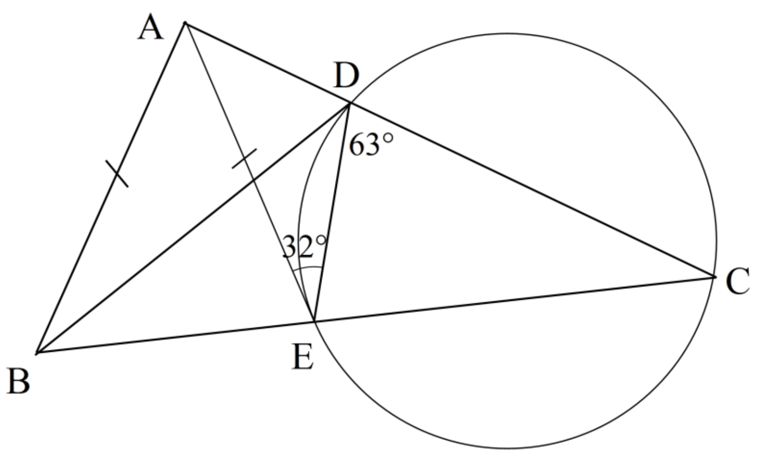


QUESTION 6.1



QUESTION 7.2

QUESTION 7.1



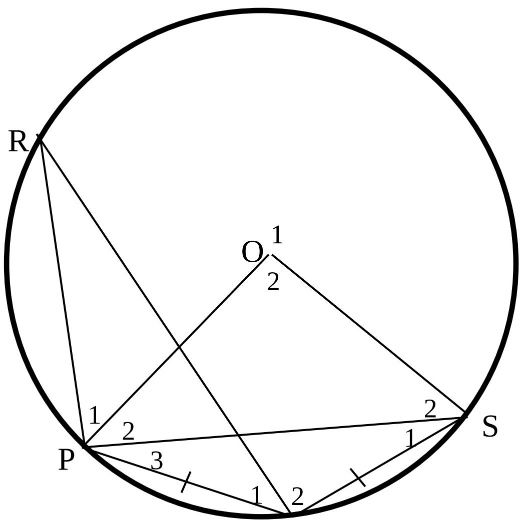


DIAGRAM SHEET

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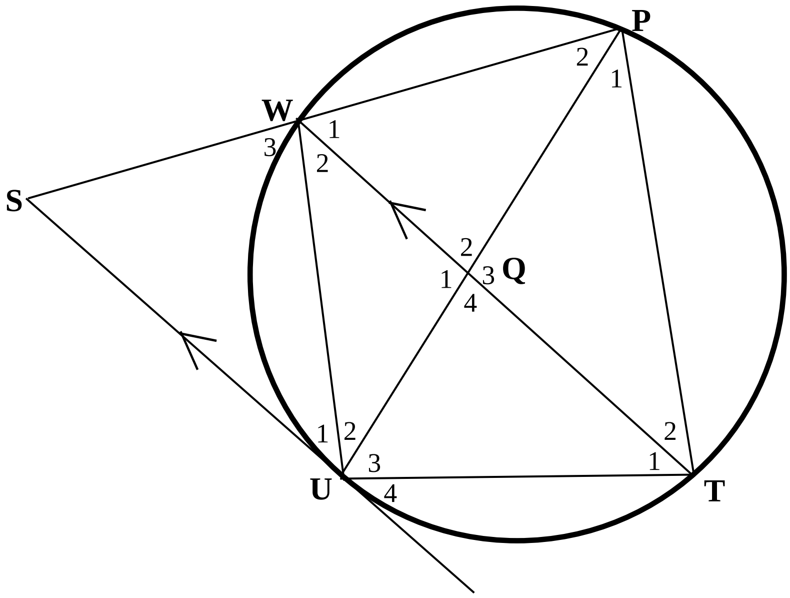
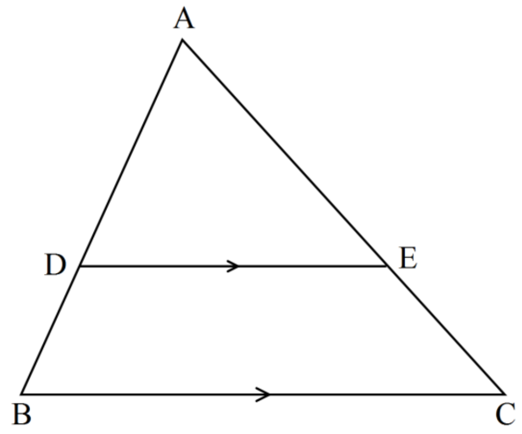
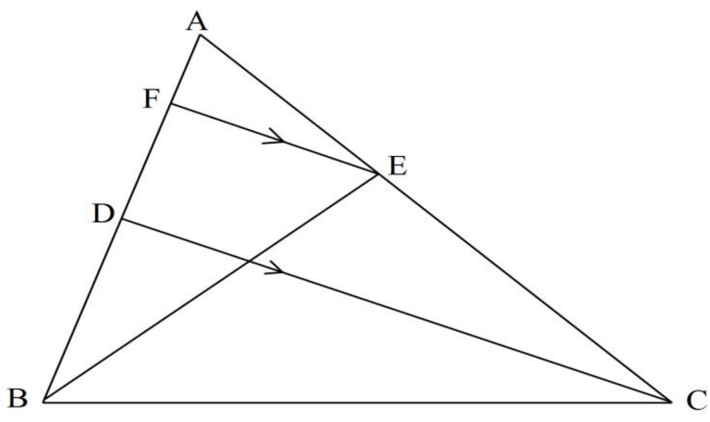
QUESTION 8



QUESTION 9.1



QUESTION 9.2



INFORMATION SHEET: MATHEMATICS
INLIGTINGSBLAD: WISKUNDE

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

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

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

$\sum_{i=1}^{n} ar^{i-1} = \frac{a\left(r^n - 1\right)}{r-1}$; $\quad r \neq 1$ $\quad \sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1-r}$; $-1 < r < 1$

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

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

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

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

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

In ΔABC:

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

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

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

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

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

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

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