KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS

COMMON TEST

MARCH 2022

TIME: 2 hours

.B. This question paper consists of 6 pages, 2 diagram sheets and an information sheet.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions.

2. Answer **ALL** 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. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.

6. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to sca

8. Number the answers correctly according to the numbering system used in this question paper. Write neatly and legibly

QUESTION 1

Given the quadratic sequence: $5;\ x;\ y;\ 29;$ ... and its second constant difference is equal to 4.

1.1 Calculate the values of x and y. (4)

1.2 If x = 9 and y = 17, determine the n^{th} term of the quadratic sequence. (4)

Calculate the 50^{th} term of the sequence. (2)

[10]

QUESTION 2

The 2^{nd} term of an arithmetic sequence is 8 and the 7^{th} term is eleven times the value of the first term. Determine the first three terms of the sequence. **[7]**

QUESTION 3

3.1 Given:

3.1.1 Write down the values of the first three terms of the series in terms of p. (1)

3.1.2 Determine the values of p for which the series is converging. (4)

3.2 The sum of the first n terms of a sequence is given by $4 - 4\left(\frac{1}{2}\right)^n$

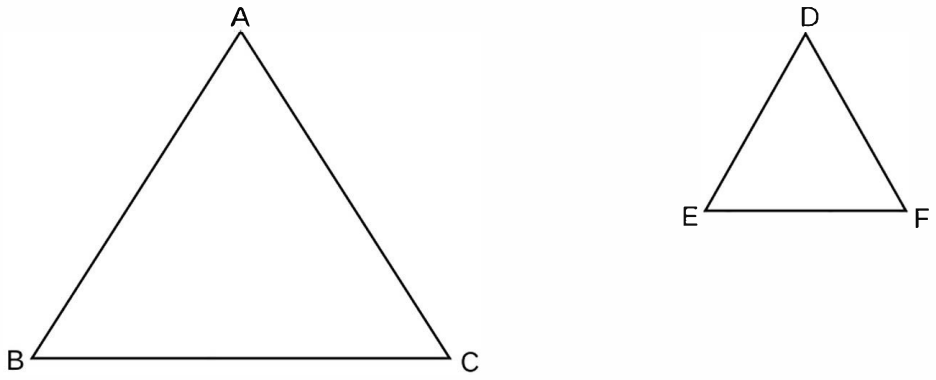
Calculate the first three terms. (5)

[10]

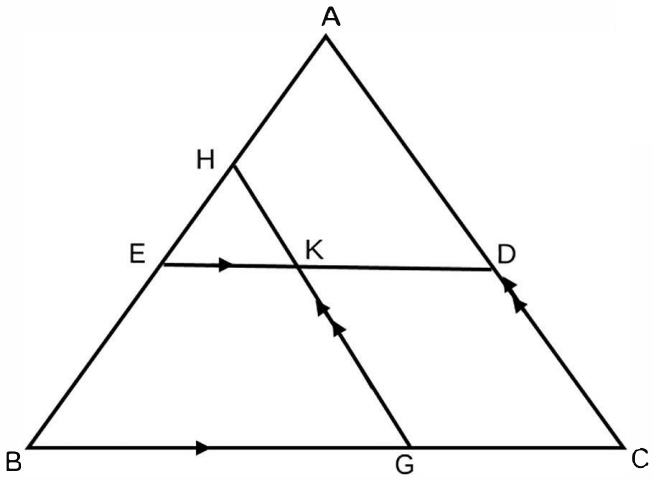
QUESTION 4

4.1 Given ΔABC and ΔDEF with $\hat{A} = \hat{D}, \hat{B} = \hat{E}$ and $\hat{C} = \hat{F}$.

Prove the theorem which states that $\frac{AB}{DE} = \frac{AC}{DF}$ (7)



4.2 In the figure, ΔABC has $HG \parallel AC$ and $ED \parallel BC$. ED and HG intersect at K. $\frac{AD}{DC} = \frac{3}{2}$ and $BG = 2GC$. AB = 15 units.



Determine with reasons the value of:

4.2.1 AE (3)

4.2.2 AH (3)

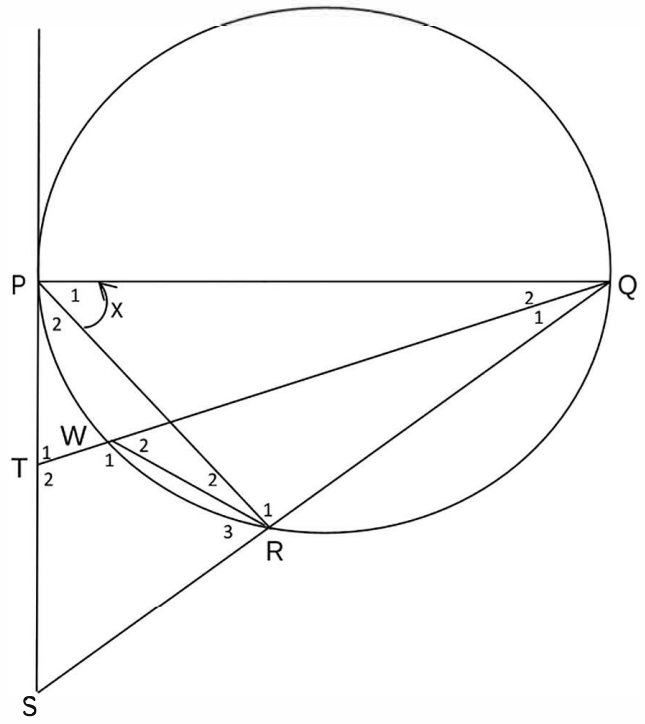
4.2.3 $\frac{GK}{KH}$ (3)

4.2.4 $\frac{\text{Area of } \Delta HEK}{\text{Area of } \Delta HBG}$ (3)

[19]

QUESTION 5

In the figure: PQ is the diameter of the circle. SP is the tangent to the circle at P.
QT intersects the circle at W and with T on the line SP. QS intersects the circle at R. $\hat{P}_1 = x$.



5.1 Give a reason why $P\hat{R}Q = 90^{\circ}$. (1)

5.2 Prove $\hat{S} = x$. (3)

5.3 Prove that SRWT is a cyclic quadrilateral. (3)

5.4 Prove that $\Delta QWR \,|||\, \Delta QST$. (3)

5.5 If QW = 5 cm, TW = 1 cm, QR = 4 cm and WR = 2 cm, calculate the lengths of:

5.5.1 TS (3)
5.5.2 SR (3)
[16]

QUESTION 6

6.1 Given $\cos 20^\circ = p$ and $\sin 14^\circ = q$

Without using a calculator, calculate the value of the following in terms of p, q or p and q.

6.1.1 $\sin 20^\circ$ (2)

6.1.2 $\cos 6^\circ$ (6)

6.2 Simplify into a single trigonometric ratio.

$$\sqrt{\frac{\frac{1}{2}\sin 2x}{\tan(540^\circ + x)\left(\frac{1}{\cos^2 x} - \tan^2 x\right)}}$$ (6)

[14]

QUESTION 7

7.1.1 Prove the following identity:

$\cos 4x = 8\cos^4 x - 8\cos^2 x + 1$ (4)

7.1.2 Hence, determine, without the use of a calculator, the general solution of

$16\cos^4 x - 16\cos^2 x + 2 = 1$ (5)

7.1.3 Write down the minimum value of the expression $16\cos^4 x - 16\cos^2 x + 2$. (2)

7.2 Calculate, without the use of a calculator, the value of:

$$\frac{2\sin^2 22.5^\circ - 1}{4\sin 22.5^\circ \cos 22.5^\circ}$$ (5)

[16]

QUESTION 8

8.1 Sketch the graphs of $f(x) = \sin(2x)$ and $g(x) = 2\cos x$

for the domain $x \in [-90^\circ; 180^\circ]$. (Use the axes provided) (6)

8.2 Use your graphs to determine the solution $\frac{g(x)}{f(x)} \geq 1$. (2)

[8]

Total: 100 marks

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INFORMATION SHEET: MATHEMATICS
INLIGTING BLADSY

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

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

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}(2a + (n-1)d)$$

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

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

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

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

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

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

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

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

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

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

$$\bar{x} = \frac{\sum f.x}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$$

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

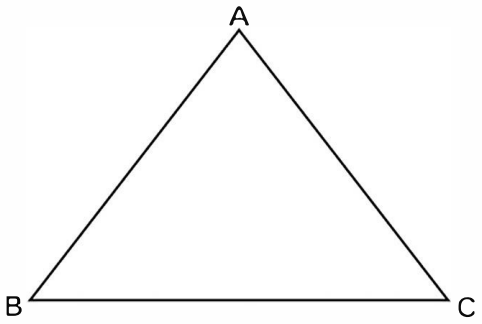
$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

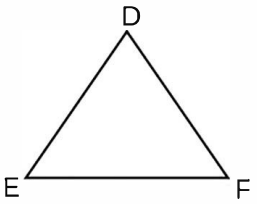
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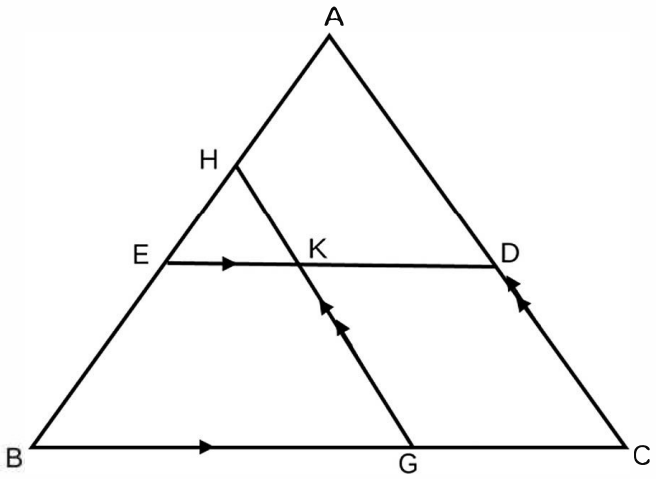
DIAGRAM SHEET

QUESTION 4.1

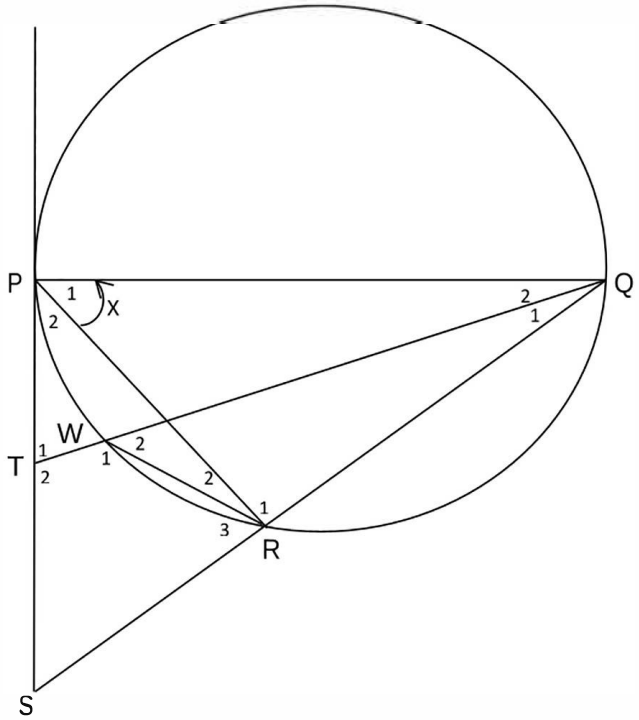




QUESTION 4.2



QUESTION 5

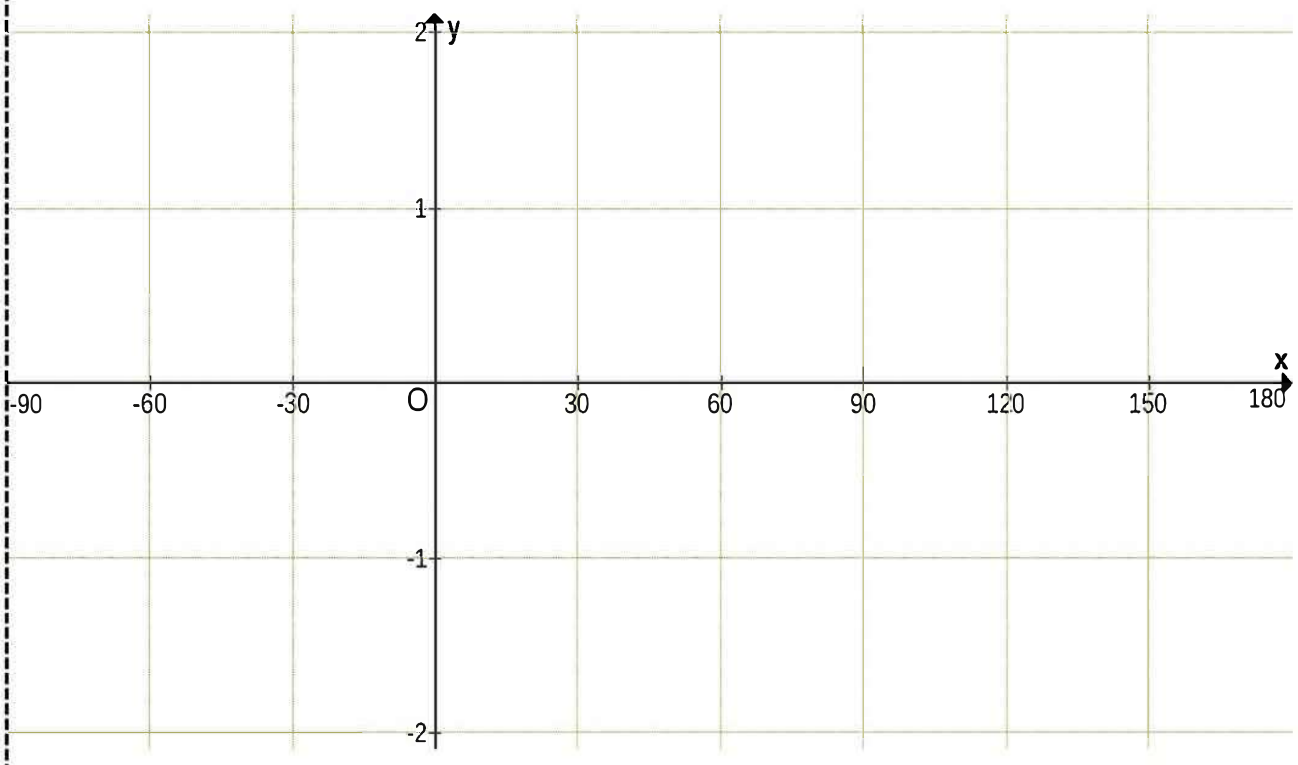


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QUESTION 8



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