



education

Department:
Education
PROVINCE OF KWAZULU-NATAL

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS

COMMON TEST

MARCH 2020

MARKS: 100

TIME: 2 hours

N.B. This question paper consists of 8 pages and an information sheet.

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 scale.
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: $p; 5; q; 19; \dots$

- 1.1 Calculate the value(s) p and q if the second constant difference is 2. (4)
- 1.2 Determine the n^{th} term of the quadratic sequence. (4)
- 1.3 Determine the first term of the sequence that will have a value greater than 10301. (4)
- [12]

QUESTION 2

The sum to n terms of an arithmetic sequence is 36. The first and last terms are 1 and 11 respectively. Determine the number of terms n and its common difference d .

[5]

QUESTION 3

- 3.1 In a geometric sequence the first term is " a " and its common ratio is " r ". Prove that the sum to n terms of the sequence is

$$S_n = \frac{a(1 - r^n)}{1 - r} \quad (4)$$

- 3.2 Given:

$$\sum_{k=1}^m 3 \cdot 2^{1-k}$$

- 3.2.1 Write down the first TWO terms of the geometric sequence. (2)
- 3.2.2 Calculate the value of m if

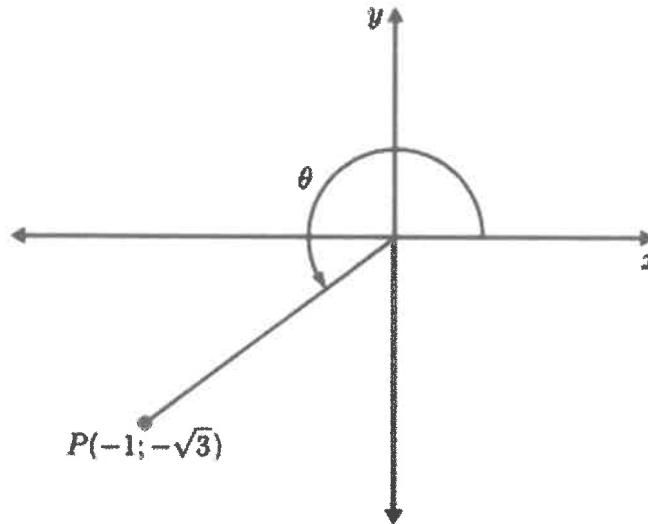
$$\sum_{k=1}^m 3 \cdot 2^{1-k} = \frac{3069}{512} \quad (5)$$

- 3.3 A ball is dropped from a height of 24 metres. Every time the ball hits the ground, it rises $\frac{3}{4}$ of its original height. Calculate the sum of the total vertical heights reached by the ball after the first bounce until it comes to rest. (3)

[14]

QUESTION 4

- 4.1 Use the diagram below to calculate, **without the use of a calculator**, the value of each of the following:



4.1.1 $\sin(-\theta)$ (3)

4.1.2 $\cos 2\theta$ (4)

- 4.2 **Without using a calculator**, determine the value of the following expressions.

4.2.1 $\sin 75^\circ \cos 45^\circ - \sin 15^\circ \cos 45^\circ$ (5)

4.2.2 $\frac{\cos 100^\circ}{\sin(-10^\circ)} \times \tan^2 120^\circ$ (6)

- 4.3

- 4.3.1 Prove that, for angles α and β .

$$\frac{\sin \alpha}{\sin \beta} - \frac{\cos \alpha}{\cos \beta} = \frac{2 \sin(\alpha - \beta)}{\sin 2\beta} \quad (4)$$

- 4.3.2 Hence, or otherwise, show that:

$$\frac{\sin 5\beta}{\sin \beta} - \frac{\cos 5\beta}{\cos \beta} = 4 \cos 2\beta \quad (3)$$

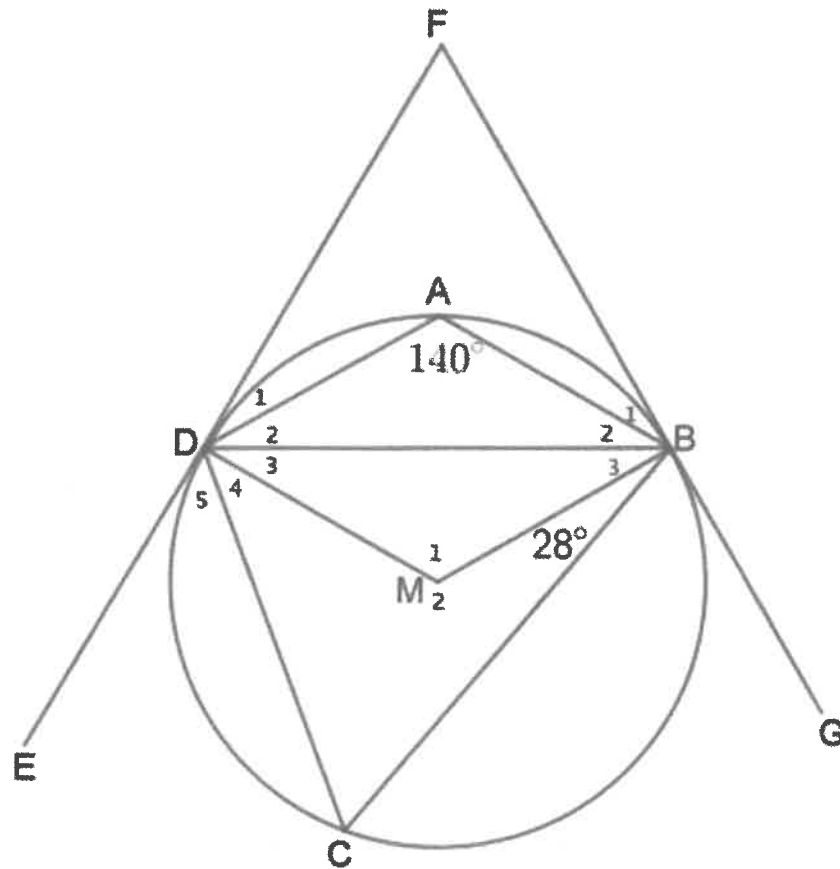
- 4.4 Determine the general solution of:

$$2 \sin^2 x - \sin x - 1 = 0 \quad (5)$$

[30]

QUESTION 5

In the diagram below, M is the centre of the circle $DABC$. EDF is a tangent to the circle at D and FBG is another tangent to the circle at B .



Calculate the following angles, with reasons:

5.1 \hat{C} (2)

5.2 \hat{M}_1 (3)

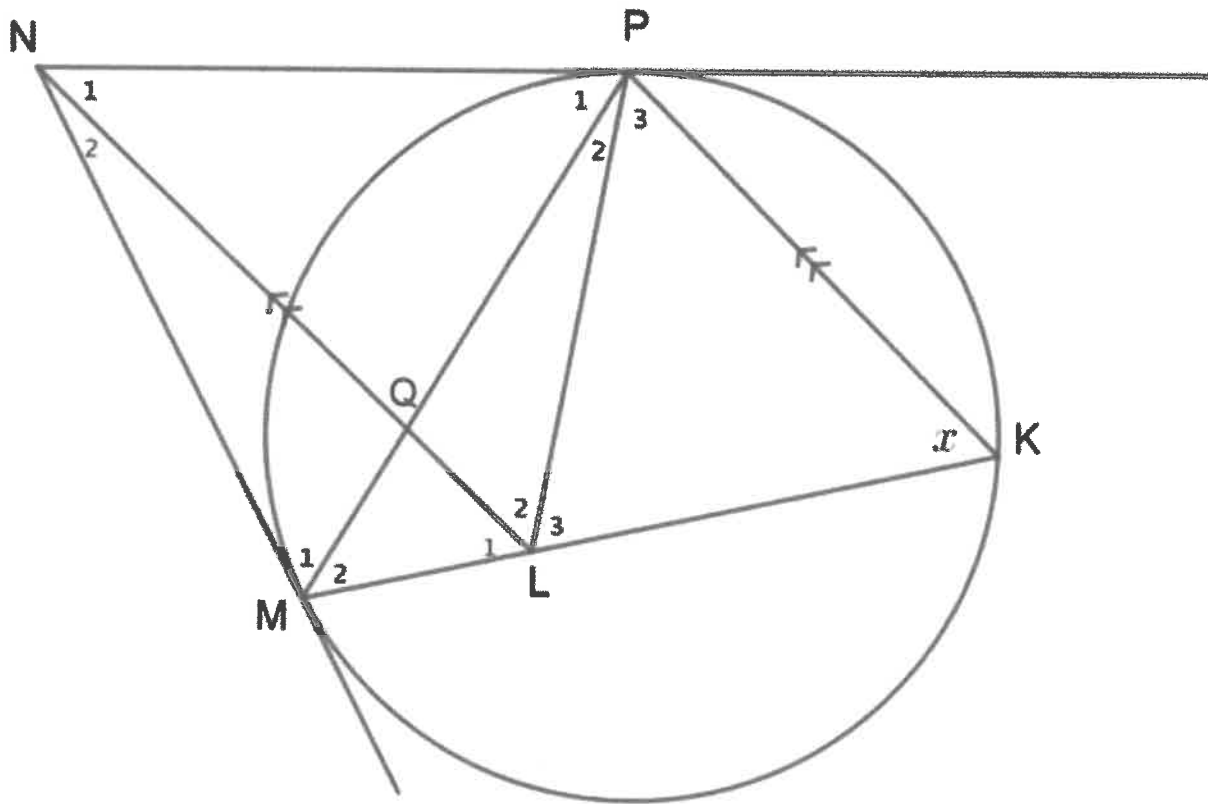
5.3 \hat{B}_3 (3)

5.4 \hat{D}_5 (2)

[10]

QUESTION 6

In the diagram below, NP and NM are tangents to the circle at P and M. K is a point on the circle KP, KM and PM are chords so that $\widehat{K} = x$. L is a point on KM so that $KP \parallel LN$, L and P are joined.



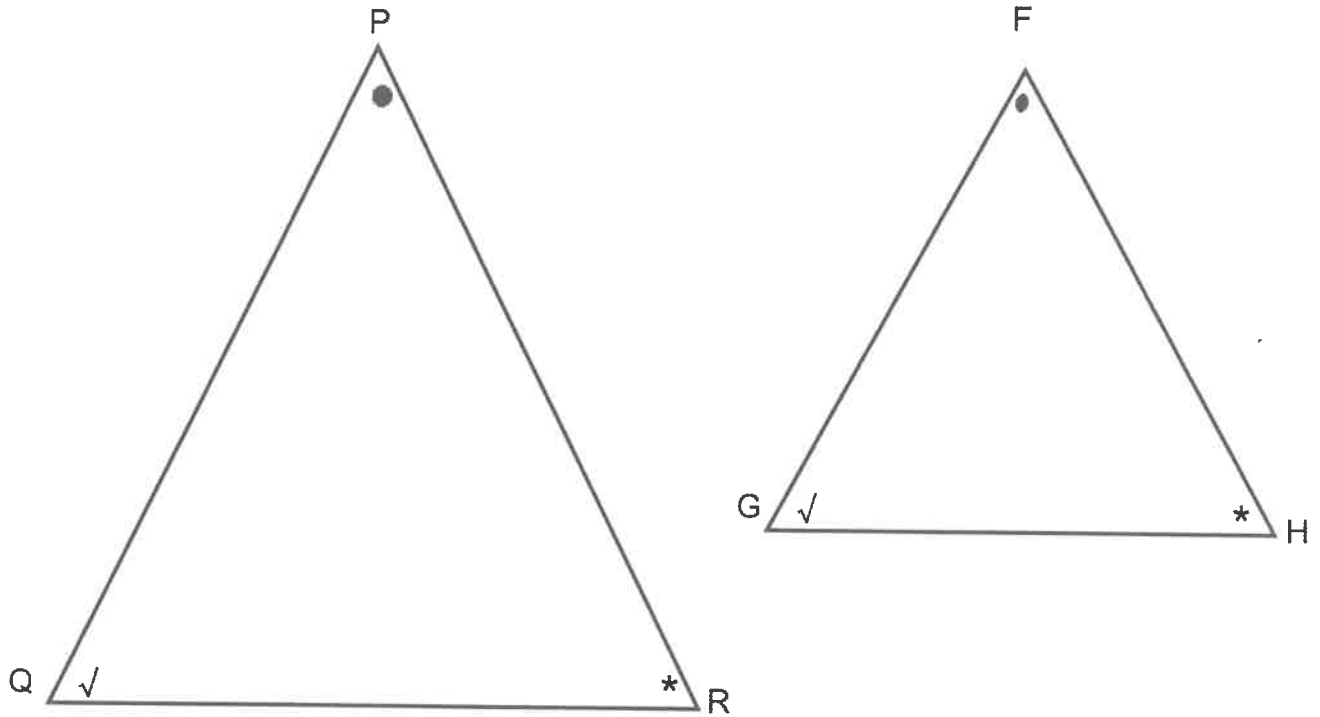
6.1 Prove that NMLP is a cyclic quadrilateral. (4)

6.2 Prove that ΔKLP is isosceles. (6)

[10]

QUESTION 7

$\triangle PQR$ and $\triangle FGH$ are given, $\hat{P}=\hat{F}$; $\hat{Q}=\hat{G}$ and $\hat{R}=\hat{H}$



Prove theorem which states that if $\triangle PQR$ and $\triangle FGH$ are equiangular, then

$$\frac{PQ}{FG} = \frac{PR}{FH}$$

[6]

