General

It is clear that in some centres candidates were well prepared for the examination. They responded pertinently to questions and presented their solutions neatly.

However it is of concern that in some centres candidates were obviously not well prepared. They lacked examination techniques and responded poorly to the theory questions. Questions were not numbered correctly and they did not know what to do with the diagram sheet or did not use these diagrams to assist in answering the questions. The impression was created that they may have used or worked on the diagrams drawn in the question paper, and lost out on possible marks which could have been awarded had these workings been shown on the diagrams provided on the diagram sheet.

Though a notice to this effect wee sent to schools, many candidates still present solutions written in pencil.

Recommendations:

- Candidates need to read questions more carefully and follow the examiner's instructions.
- Candidates need to be taught to manage their time in such a way that all questions receive sufficient time.
- Diagrams sheets should be provided in all internal examinations
- Candidates should start each question on a new page and answer questions correctly.
- Candidates should be informed that except for diagrams and graphs, no solutions should be written in pencil.
- Candidates should keep the order of subsections in the given sequence.
- The teaching of geometry should receive special attention
- The grade 11 syllabus should be completed in the grade 11 year
- A structured revision programme or tutorials should be implemented in the grade 12 year.

Specific Questions

Question 1

1.1 It is important that candidates analyse and use diagrams on the Cartesian plane as a strategy to solve problems in Analytical Geometry. In this way they will not be tempted to execute long and unnecessary calculations for problems counting 1 or 2 marks as was the case in 1.1.

1.2 Candidates knew how to approach this question. However they should realise that if tanx <0, then angle of inclination must be obtuse. A number of candidate calculated the lengths of various sides and used trigonometric approaches to good effect in determining the size of $\hat{A}$

1.3 Altitude and median were confused.

1.4 Some candidates assumed incorrectly that E is the midpoint of AM

1.5 Most candidates knew the formula for the area of a triangle, but could not determine the correct sides to substitute in the formula.

Question 2

2.1.1 This question was well answered but a number of candidates performed long calculations for only 2 marks.

2.1.2 Candidates who started by translating the given equation into the "centre radius" form only received 2 marks unless they also showed that the coordinates of B satisfies the equation or calculated BC to show that the radius obtained corresponds the length of BC.

2.1.3 This question was poorly understood. Candidates should be exposed to vertical and horizontal tangents as well as the tangents to the radii.

2.1.4 (a) Some candidates presented long calculations when all that was required was to say that BD = 5, noting that the radius is perpendicular to the tangent and hence ΔBCD is isosceles.

(b) To find the coordinates of D candidates had to solve two equations simultaneously. Many candidates struggled to determine the second equation, whether it was the equation of DC or an equation obtained by considering the length of BD.

Many candidates found creative ways of determining the coordinates of D correctly by reasoning from the diagram and using the gradient of BD which could be deduced from the given equation:

Equation of BD is 3x – 4y + 8 = 0. Thus $y = \frac{3}{4}x + 2$

$\therefore\ m_{BD} = \frac{3}{4}$ and BD = 5

$\therefore x_D = 0 + 4 = 4$ and $y_D = 2 + 3 = 5$

$\therefore$ D (4 ; 5)

2.1.5 Candidates were familiar with this concept

2.2 Many candidates could not interpret the condition of the locus to be PR = 2PT.

Question 3

3.2 Candidates were answered this question well but some made mistakes with the signs when reducing to acute angles.

3.3 Candidates must show the negative signs in the reduction to the acute angle and must not cancel them mentally:

$$\tan(-207°)\tan(333°) = (-\tan 27°)(-\cot 27°)$$
$$= 1$$

Far too many candidates simply lost the $\sqrt{\ }$ sign in the calculations.

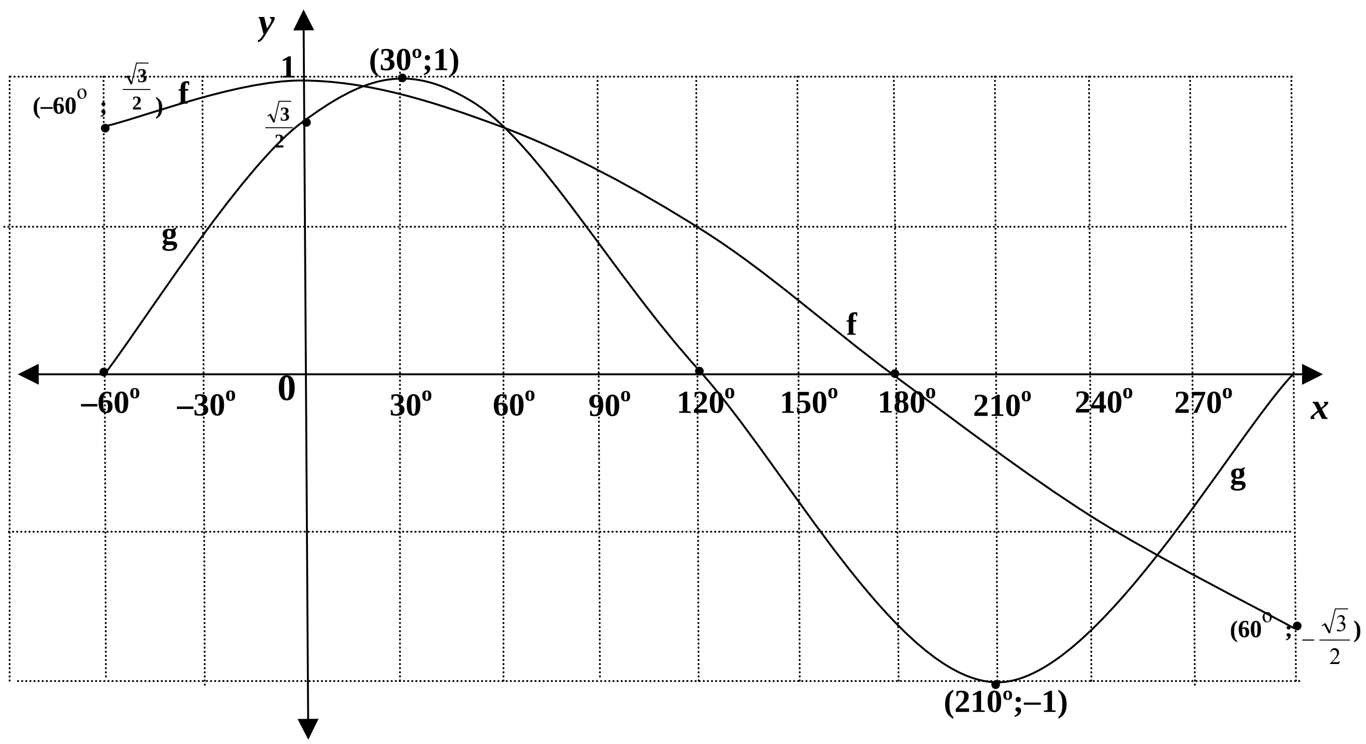
Question 4

4.1 Many candidates failed to realise the relationship between co-functions provided the basis for solving the given equation:

$\sin(x + 60^\circ) = \sin\left(90^\circ - \frac{1}{2}x\right)$ **OR** $\sin(x + 60^\circ) = \sin\left(180^\circ - 90^\circ + \frac{1}{2}x\right)$

Some candidates first drew the graphs and deduced the solutions from the graph, obviously not obtained exact valuses for all the solutions required.

4.2 **Co-ordinates** must be clearly shown as instructed. Candidates lost marks, especially for not showing the coordinates of the endpoints of f(*x*) and the y-intercept of g(*x*). The graphs with the labeling is reproduced as an example of what is required.



4.3 This question was not well answered. It is advisable to teach candidates to use the following notation in these types of questions as it eliminates notation errors:

4.3.1 $x \in (20^\circ ; 60^\circ)$ or $x \in (260^\circ ; 300^\circ]$

4.3.2 $x \in [120^\circ ; 180^\circ]$ or $x = -60^\circ$ or $x = 300^\circ$

Question 5

5.1 In writing down the general solution candidates must specify that $n \in z$. Quite a few learners struggled with quadratic trig equation.

5.2.2 When substituting two terms for one, make sure that brackets are used, as many errors result from sloppy substitution when they wrote down the expansions for cos 2θ and . sin 2θ

5.2.3 This question was well answered

Question 6

6.1 Candidates may and should use the area rule to prove the sine rule. The area rule does not have to be proved first, it may simply be stated.

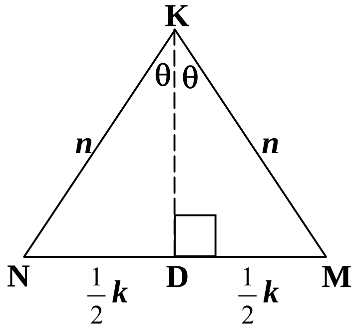
Area Δ PQR = $\frac{1}{2}$ p.r. sin Q and Area Δ PQR = $\frac{1}{2}$ q.r sin P

$\frac{1}{2}$ p.r. sin Q = $\frac{1}{2}$ q.r.sin P

$$\frac{\frac{1}{2}\text{p.r} \sin Q}{\frac{1}{2}.\text{p.r.q}} = \frac{\frac{1}{2}\text{q.r} \sin P}{\frac{1}{2}.\text{p.r.q}}$$

$$\frac{\sin Q}{q} = \frac{\sin P}{p}$$

6.2 This question was well answered with many creative solutions being presented, e.g. constructing a perpendicular form K to NM.



Draw perpendicular KD. So ND = DM = $\frac{1}{2}k.$

Hence cos N = $\frac{\frac{1}{2}k}{n}$ Therefore n cos (90°– θ) = $\frac{k}{2}$

giving 2n .sinθ = k as required.

OR : sinθ = $\left(\frac{\frac{1}{2}k}{n}\right)$, thus 2$n$. sin$\theta$ = 2n $\left(\frac{\frac{1}{2}k}{n}\right)$ = k as required.

6.2.1 Candidates really struggled with the manipulations in this question and generally worked towards the answer, changing terms and signs at random along the way to obtain the given expression on the right hand side.

6.3.2 Calculator work was poorly handled in this question.

Question 7

7.1 Candidates could reproduce the proof of this theorem but failed to indicate the correct construction.

7.2 Falsely assuming that any line from the centre of a circle automatically meets a chord perpendicularly at its midpoint caused many candidates to lose many marks. Either the **midpoint of the chord** or the **right angle** has to be known before the other may be deduced Candidates assumed that the angles at F were 90°and were penalised. Many candidates could provide an acceptable justification for 7.2.2
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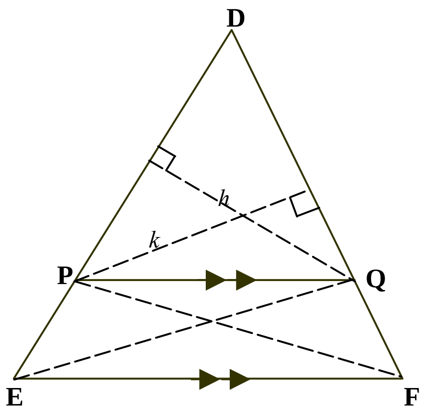
Question 8

8.1 Candidates generally attempted to prove the theorem using the two short sides $\frac{PD}{PE} = \frac{PQ}{QF}$. They lost only 1 marked if they did not conclude that $\frac{DP}{DE} = \frac{DQ}{DF}$

In the proof of the latter they had to show the following steps. Note that it is not necessary to show the altitudes *h* and *k* in which case the **alternative reasons** in brackets must be given.

Constr: Join PF and QE

Proof:



$$\frac{\text{area } \Delta \text{DPQ}}{\text{area } \Delta \text{DEQ}} = \frac{\frac{1}{2}\text{DP} \cdot h}{\frac{1}{2}\text{DE} \cdot h}$$ **(or same height)**

$$= \frac{\text{DP}}{\text{DE}}$$

$$\frac{\text{area } \Delta \text{DPQ}}{\text{area } \Delta \text{DPF}} = \frac{\frac{1}{2}\text{DQ} \cdot k}{\frac{1}{2}\text{DF} \cdot k}$$ **(or same height)**

$$= \frac{\text{DQ}}{\text{DF}}$$

but, area Δ PQE = area Δ PQF (same base, same height)

∴ area Δ DEQ = area Δ DPF (Δ DPF common)

$$\therefore \frac{\text{area } \Delta \text{DPQ}}{\text{area } \Delta \text{DEQ}} = \frac{\text{area } \Delta \text{DPQ}}{\text{area } \Delta \text{DPF}}$$

$$\frac{\text{DP}}{\text{DE}} = \frac{\text{DQ}}{\text{DF}}$$

8.2 This question was prticularly challenging as learners could not express their thinking processes on paper. Those who could write down the correct answers without explanation were credited. Candidates should refrain from giving the length of the sides in terms of numbers only. It is advisable to use variables, e.g. let OM = *x*, therefore AO = 2*x*, etc.

Question 9

9.1 This question was not well answered. Learners wrote down a lot of extraneous information which was not relevant to answer the question. Whilst they are not penalised they forfeit valuable time.

9.2 This question was not well answered

9.3 This question was well answered, but learners lost a mark for nor supplying a reason for the final conclusion.

9.4 This question was well answred. Most learners were able to identify the relevant triangles

9.5 This question required creative thinking and many candidates failed to attemp this question.