Springs Boys High School
Grade 11 Mathematics
Controlled Test Paper 2
June 2022

Examinator: Mr. Wessels **Total: 100 Marks**
Moderator: Mr. Ratsela & Mrs. Reynecke **Duration: 2 hours**

Name: _____

Teacher: _____

Instructions:

- Answer all the questions.
- Write neatly and legibly.
- Write your name at the top of your answer sheet.
- Indicate your class teachers' code at the top of your answer sheet.
- Label the questions according to the numbering used on the question paper.
- Leave answers in simplest root form or two decimal places unless otherwise stated.
- Show all calculations. Answer only will not necessarily get full marks.
- Clearly indicate your class and write your name on your question paper.
- The use of a non-programmable calculator is permitted, unless otherwise stated.
- This assessment contains 6 pages (including the cover page) and 3 questions.

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1. **Question 1** **[30]**

In the diagram below, $ABCD$ is a parallelogram with coordinates $A(1;2)$, $B(7,2)$, $D(5;5)$ and $C(x;y)$.

1.1. Calculate the length of segments AB and DE. (4)

1.2. Calculate the length of the segment AD. (4)

1.3. Determine the equation of the line passing through B and C. (4)

1.4. Determine the equation of the line passing through D and C. (2)

1.5. Use your answers in 1.3 and 1.4 to determine the coordinate of C. (3)

1.6. Show that AC and BD have the same midpoint. (3)

1.7. Show that the diagonals of $ABCD$ do not intersect at a right angle. (4)

1.8. Use your answer from 1.1 to calculate the area of the parallelogram. (3)

1.9. Determine the inclination angle of the line passing through A and D. (3)

2. **Question 2** **[43]**

2.1. Without using a calculator, simplify the following expression to a single ratio:

2.1.1. $\dfrac{\tan(180^o-\theta)\sin(360^o+\theta)}{\cos(180^o+\theta)\tan(360-\theta)}$ (6)

2.1.2. $\cos(315^o)\cos(405^o)+\sin(45^o)\sin(135^o)$ (6)

2.2. Prove the following identities:

2.2.1. $\dfrac{(\cos\theta-1)(\cos\theta+1)}{(\sin\theta-1)(\sin\theta+1)} = -\tan\theta$ (6)

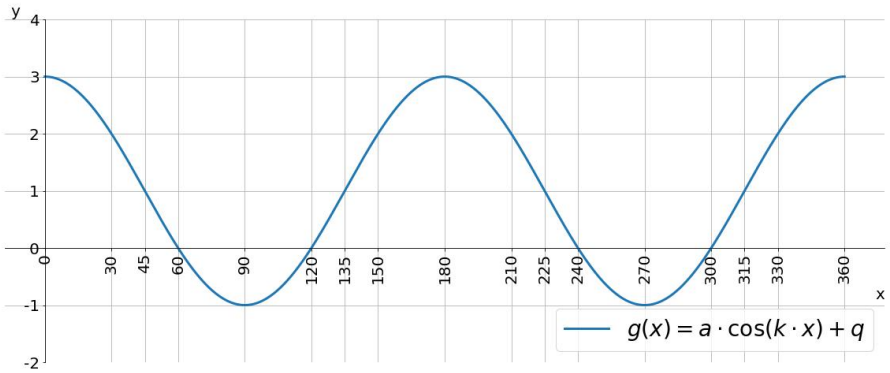
2.2.2. $\dfrac{1-\sin\theta}{\cos\theta} = \dfrac{\cos\theta}{1+\sin\theta}$ (5)

2.3. Given coordinate $P(-4, y)$ and $\tan\theta > 0$;

2.3.1. Construct a triangle in the relative quadrant to represent θ. (3)

2.3.2. Calculate $\cos(180^o - \theta)$. (3)

2.4. The trigonometric function $g(x) = a \cdot \cos(k \cdot x) + q$ is sketched below:

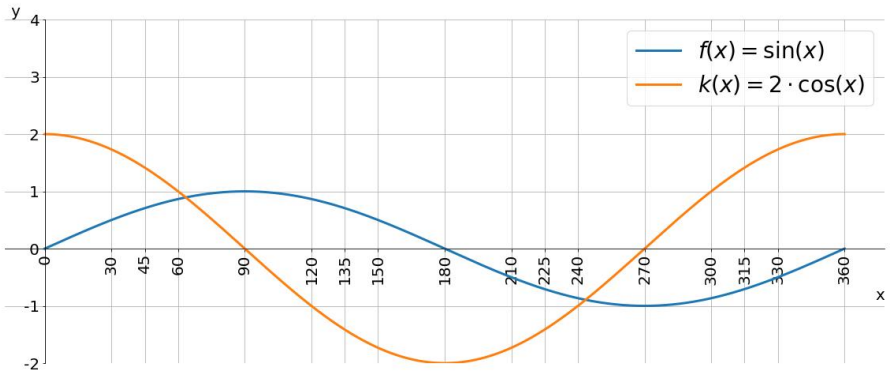


2.4.1. What is the domain of $g(x)$? (2)

2.4.2. Write down the equation of the function $g(x)$. (3)

2.4.3. If $h(x) = g(x) - 1$, write down the and range of $h(x)$. (3)

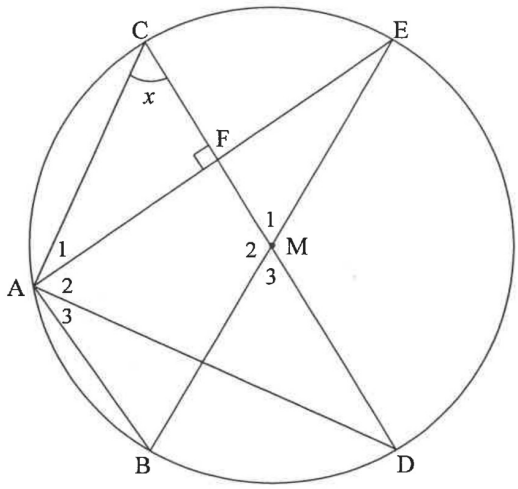
2.5. Below are the graphs of $f(x) = \sin(x)$ and $k(x) = 2\cos(x)$:



2.5.1. Determine the values of x where the $f(x) = k(x)$. (5)

3. Question 3 [28]

3.1. In the diagram below, BE and CD are diameters of a circle with center M. Chord AE is drawn to cut CD at F. $AE \perp CD$ and $\hat{C} = x$.

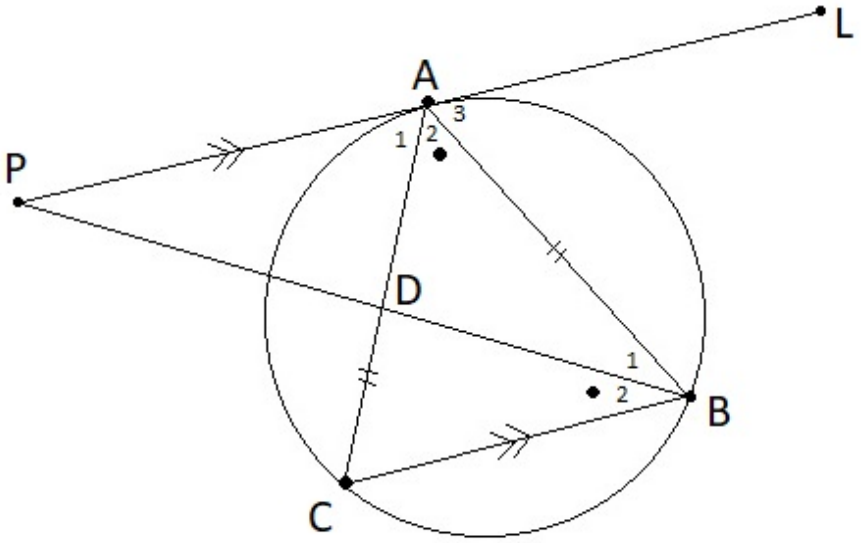


3.1.1. Give a reason why $AF = EF$. (1)

3.1.2. Determine with reason the size of $\hat{M}_1$ in terms of x. (4)

3.1.3. Prove that AD is a tangent to the circle passing through A, C and F (6)

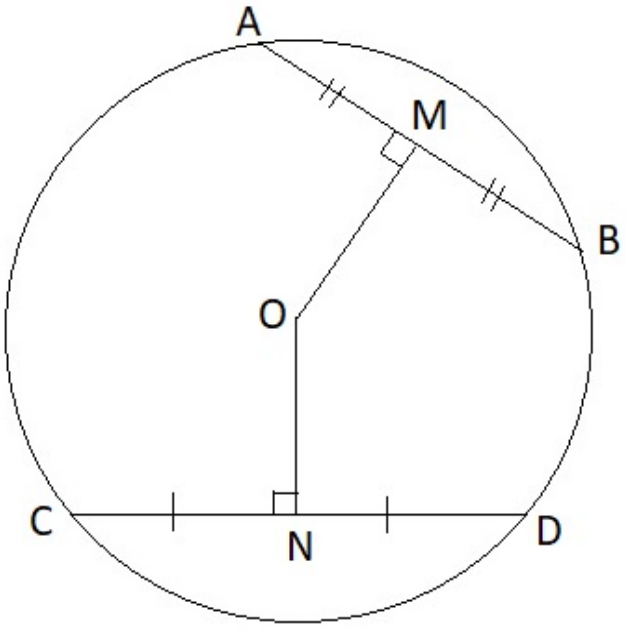
3.2. In the diagram below, $APL \parallel CB$ and $\hat{A}_2 = \hat{B}_2$.



3.2.1. Prove that PAL is a tangent to circle ABC (6)

3.2.2. Prove that AB is a tangent to the circle ADP (6)

3.3. In the diagram below O is the center of the circle, $OM \perp AB$, $ON \perp CD$, $AB = 60$ mm, $OM = 40$ mm and $ON = 30$ mm.



3.3.1. Calculate the radius of the circle (2)

3.3.2. Calculate the length of CD (3)