LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

GRADE 12

MATHEMATICS
TEST 1
MARCH 2026

MARKS: 100 **DURATION: 2 HOURS**

This Question papers consists of 8 pages and 1 information sheet.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of EIGHT questions.
2. Clearly show ALL calculations, diagrams, et cetera which you have used in determining the answers.
3. Number the answers correctly according to the numbering system used in the question paper.
4. ANSWER ONLY will not necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

QUESTION 1

Solve for x

1.1 $x^2 - 2x + 1 > 0$ (3)

1.2 $2x - 1 = \sqrt{4 - 5x}$ (4)

[7]

QUESTION 2

2.1 Given the finite arithmetic sequence: 5 ; 1 ; -3 ; … , -83 ; -87

2.1.1 Write down the fourth term (T_4) of the sequence. (1)

2.1.2 Calculate the number of terms in the sequence. (3)

2.1.3 Calculate the sum of all the negative numbers in the sequence. (3)

2.2 The tenth and the seventeenth terms of an arithmetic sequence are 21 and 49 respectively

2.2.1 Determine the common difference of the sequence. (3)

2.2.2 Calculate: $T_1 + T_{18}$ (3)

2.3

Given: $\sum_{n=1}^{m} (4n - 19) = 1189$

2.3.1 Write down the first three terms of the series. (1)

2.3.2 Calculate the value of m. (4)

[18]

QUESTION 3

3.1 - 78; - 76; - 72; - 66; … is a quadratic number pattern.

3.1.1 Write down the next two terms of the number pattern. (1)

3.1.2 Determine the n^{th} term of the number pattern in the form, $T_n = an^2 + bn + c$ (4)

3.2 Given: 5; 10; 20; … a geometric sequence.

3.2.1 Determine the n^{th} term (1)

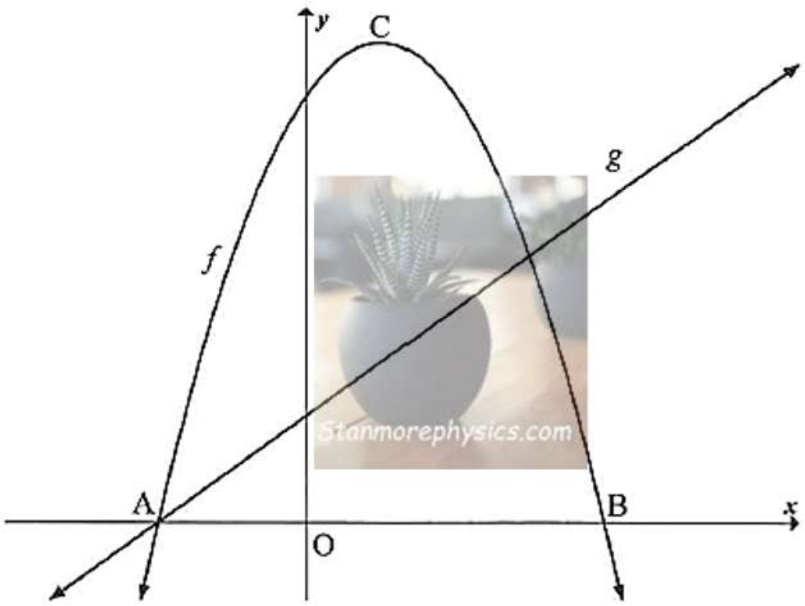
3.2.2 Calculate the sum of the first 18 terms. (2)

3.3 The first and second term of a geometric series is given as $(2x - 4)$ and $(4x^2 - 16)$ respectively. Determine the value(s) of x for which the series will converge. (4)

[12]

QUESTION 4

Sketched below are the graphs of $f(x) = -2x^2 + 4x + 16$ and $g(x) = 2x + 4$.
A and B are the x-intercepts of f. C is the turning point of f.



4.1	Calculate the coordinates of A and B.	(3)
4.2	Determine the coordinates of C, the turning points of f.	(2)
4.3	Write down the range of f.	(1)
4.4	The graph of $h(x) = f(x + p) + q$ has a maximum value of 15 at $x = 2$. Determine the values of p and q	(3)
4.5	Determine the equation of g^{-1}, the inverse of g, in the form $y = \ldots$	(2)
4.6	For which value(s) of x will $g^{-1}(x).g(x) = 0$?	(2)

[13]

QUESTION 5

Given the exponential function: $f(x) = 3^x$

5.1 Write down the range of f. (1)

5.2 Determine the equation of f^{-1} in the form $y = \ldots$ (2)

5.3 The point M$(a\,;2)$ lies on f^{-1}. Calculate the value of a. (2)

5.4 Sketch, in your answer book, the graphs of f and f^{-1}, showing clearly ALL intercepts with axes (include the second point on each graph). Draw and name the line of symmetry between the two graphs. (5)

5.5 Is f^{-1} a function? Justify your answer. (2)

[12]

QUESTION 6

6.1 If $\cos\theta = -\frac{5}{13}$ where $180° < \theta < 360°$, determine, **without using a calculator,** the value of:

6.1.1 $sin^2\,\theta$ (3)

6.1.2 $\cos\,(\theta - 135)$ (4)

6.2 Prove that $2cos^2(45° + 1) = 1 - sin2x$ (4)

6.3 Consider the expression: $\sin(A - B) - \sin(A + B)$

6.3.1 Prove that $\sin(A - B) - \sin(A + B) = -2cosAsinB$. (2)

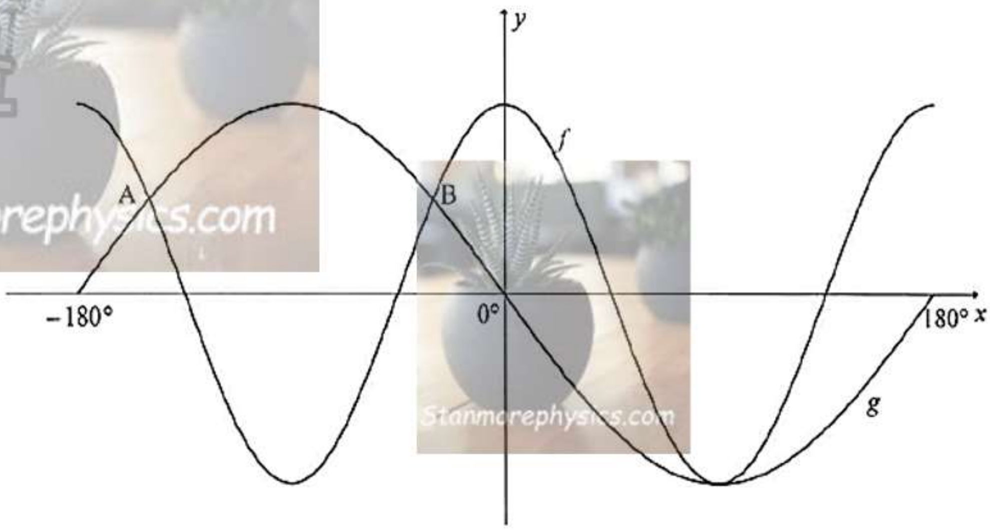
6.3.2 Simplify the following expression to a single term: $sin4x - sin10x$. (2)

6.3.3 Hence, determine the solution for $sin4x - sin10x = sin3x$ for $x \in [0°; 30°]$. (5)

[20]

QUESTION 7

In the diagram below, the graph of $f(x) = cos2x$ and $g(x) = -sinx$ are drawn for the interval $x \in [-180° ; 180°]$ A and B are two points of intersections of f and g.



7.1 Write down:

7.1.1 The period of f (1)

7.1.2 The amplitude of g (1)

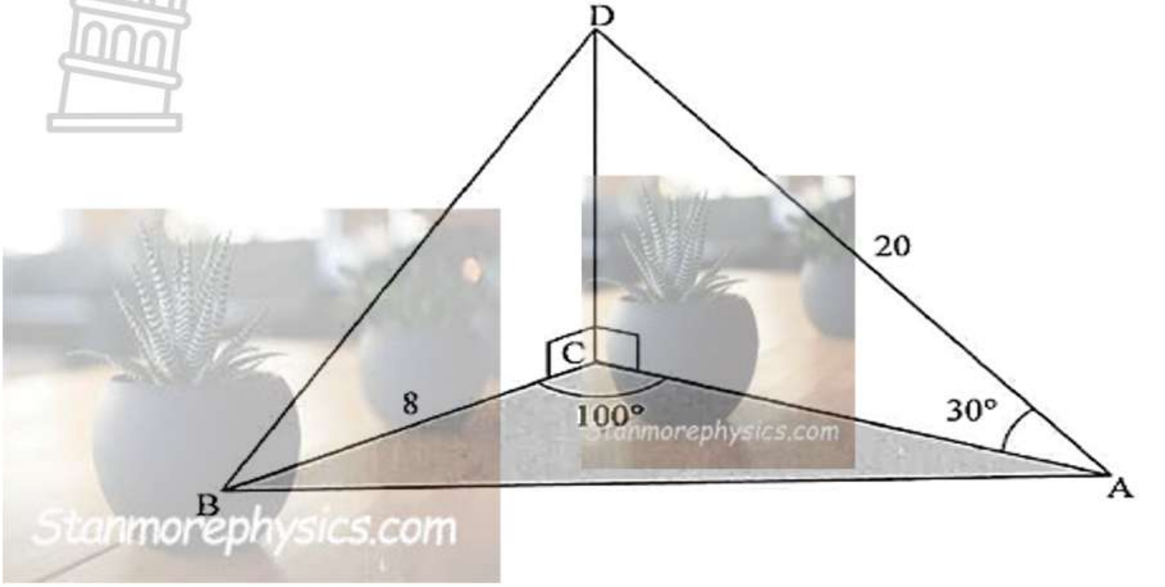
7.2 **Without using a calculator**, determine the value of x for which $cos2x = -sinx$ in the interval $x \in [-180° ; 180°]$. (6)

7.3 Use the graphs above to determine how many degrees apart are points A and B from each other? (2)

[10]

QUESTION 8

In the diagram, A, B and C are points in the same horizontal plane. D is a point directly above C, that is DC ⊥ AC and DC ⊥ BC. It is given that $A\hat{C}B = 100°$, $C\hat{A}D = 30°$, AD = 20 units and BC = 8 units.



8.1 Calculate the length of:

8.1.1 AC (2)

8.1.2 AB (3)

8.2 If it is further given that $A\hat{B}D = 73{,}4°$, calculate the size of $A\hat{D}B$. (3)

[8]

TOTAL: [100]

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$

$a^2=b^2+c^2-2bc.\cos A$

area $\Delta ABC=\frac{1}{2}ab\sin C$

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

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

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

$\sin 2\alpha=2\sin\alpha\cos\alpha$

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

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

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

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MATHEMATICS
TEST 1
MARKING GUIDELINES
MARCH 2026

MARKS: 100

These marking guidelines consists of 11 pages

NOTE:

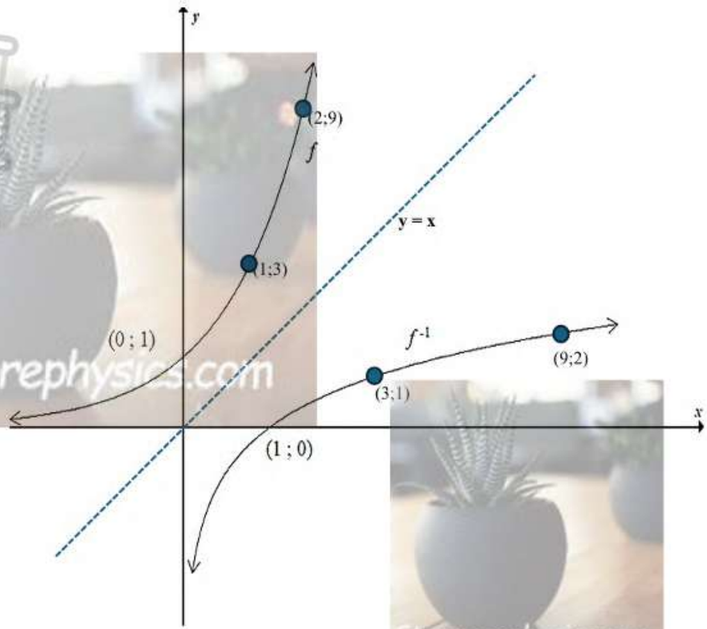
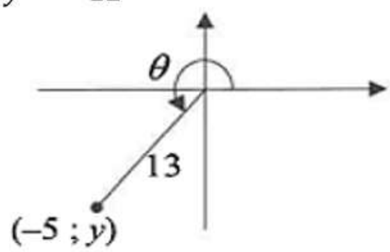
- If a candidate answers a question **TWICE,** only mark the **FIRST** attempt.
- If a candidate crossed out an attempt of a question and not redone the question**,** mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking guidelines. Stop marking at the second calculation error.
- Assuming answers/values to solve a problem is **NOT** acceptable**.**

Question 1		
1.1.1	$x^2 - 2x + 1 > 0$ $(x-1)(x-1) > 0$ $Critical\ value:\ x = 1$ $x<1 \quad or \quad x>1$ OR $\therefore x \in \mathbb{R}, x \neq 1$	✓ factors ✓✓correct notation (Accuracy) ✓✓ $x \in \mathbb{R}, x \neq 1$ (Accuracy) (3)
1.1.2	$2x - 1 = \sqrt{4-5x}$ $(2x-1)^2 = \left(\sqrt{4-5x}\right)^2$ $4x^2 - 4x + 1 + 5x - 4 = 0$ $4x^2 + x - 3 = 0$ $(4x-3)(x+1) = 0$ or $x = \frac{-1 \pm \sqrt{(1)^2 - 4(4)(-3)}}{2(4)}$ $\therefore x = \frac{3}{4}$ or $x \neq -1$	✓ squaring both sides ✓ standard form ✓ factors ✓ answers with selection (4)
		[7]
Question 2		
2.1.1	$T_4 = -7$	✓ -7 (1)
2.1.2	$T_n = a + (n-1)d$ $-87 = 5 + (n-1)(-4)$ $-87 = 5 - 4n + 4$ $4n = 96$ $n = 24$ **OR** $-4n + 9 = -87$ $-4n = -96$ $n = 24$	✓ $a = 5$ and $d = -4$ ✓ $-87 = 5 + (n-1)(-4)$ ✓ $n = 24$ **OR** ✓ $-4n + 9$ ✓ $-4n + 9 = -87$ ✓ $n = 24$ (3)
2.1.3	-3 ; -7 ; … ; -87 $S_n = \frac{n}{2}[a + T_n]$ $S_{22} = \frac{22}{2}[-3 - 87]$ $S_{22} = -990$	✓ $n = 22$ ✓ $a = -3$ ✓ answer

	OR $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{22} = \frac{22}{2}[2(-3) + (22-1)(-4)]$ $= -990$ **OR** All negative terms can be written down and added to get the answer of -990 **OR** $Sum = S_{24} - (5+1)$ $= \frac{24}{2}[5 - 87] - 6$ $= -990$	✓ $n = 22$ ✓ $a = -3$ ✓ answer ✓ $a = -3$ ✓ ✓answer ✓ $\frac{24}{2}[5-87]$ ✓ -6 ✓ answer (3)
2.2.1	$a + 9d = 21$ $a + 16d = 49$ $\therefore\ -7d = -28$ $d = 4$	✓$a + 9d = 21$ ✓$a + 16d = 49$ ✓ value of d (3)
2.2.2	$a + 9(4) = 21$ $a = -15$ $T_{18} = T_{17} + 4$ $= 49 + 4$ $T_{18} = 53$ $\therefore\ T_1 + T_{18}$ $= -15 + 53$ $= 38$	✓ $a = -15$ ✓ $a = -15$ ✓ answer (3)
2.3.1	$T_1 = 4(1) - 19 = -15$ $T_2 = 4(2) - 19 = -11$ $T_3 = 4(3) - 19 = -7$	✓ all three terms (1)
2.3.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_m = \frac{m}{2}[2(-15) + 4(m-1)]$ $1189 = \frac{m}{2}[-30 + 4m - 4]$ $0 = 2m^2 - 17m - 1189$ $(2m + 41)(m - 29) = 0$ $\therefore m = 29 \quad or \quad m \neq -\frac{41}{2}$	✓ substitution and = 1189 ✓ standard form ✓ Factors ✓ answer (4)
		[18]

Question 3		
3.1.1	$-58\,;\,-48$	✓ Both answers (1)
3.1.2	$T_n = an^2 + bn + c$ $2a = 2\,;\quad 3a + b = 2\,;\quad a + b + c = -78$ $a = 1\,;\quad 3(1) + b = 2\,;\quad 1 - 1 + c = -78$ $b = -1\quad c = -78$ $\therefore T_n = n^2 - n - 78$	✓ $a = 1$ ✓ $b = -1$ ✓ $c = -78$ ✓ answer (4)
3.2.1	$5;\,10;\,20;\,\ldots .T_n = a.r^{n-1}$ $T_n = (5)(2)^{n-1}$	✓ answer (1)
3.2.2	$S_n = \dfrac{a(r^n - 1)}{r - 1}$ $S_{18} = \dfrac{5[(2)^{18} - 1]}{2 - 1}$ $S_{18} = 1310715$	✓ substitution into the correct formula ✓ answer (2)
3.3	$r = \dfrac{(2x+4)(2x-4)}{2x-4} = 2x + 4$ Converge: $-1 < r < 1$ $-1 < 2x + 4 < 1$ $-5 < 2x < -3$ $-\dfrac{5}{2} < x < -\dfrac{3}{2}$	✓ $r = 2x + 4$ ✓ $-1 < r < 1$ ✓ substitution ✓ answer (4)
		[12]
Question 4		
4.1	$-2x^2 + 4x + 16 = 0$ $x^2 - 2x - 8 = 0$ $(x-4)(x+2) = 0$ $x = 4$ or $x = -2$ $\therefore A(-2;0)$ and $B(4;0)$	✓ factors ✓ $x = -2$ ✓ $x = 4$ (3)
4.2	$f(x) = -2x^2 + 4x + 16$ $-\dfrac{b}{2a} = -\dfrac{-4}{-2(2)} = 1$ $f(1) = -2(1)^2 + 4(1) + 16 = 18$ $\therefore C(1;18)$	✓ 1 ✓ 18 (2)
4.3	$y \leq 18$ **OR** $y \in (-\infty;18]$	✓ $y \leq 18$ **OR** ✓ $y \in (-\infty;18]$ (1)

4.4	TP (1 ; 18) for f TP (2 ; 15) for h $\therefore p=-1 \qquad q=-3$	✓ TP (2 ; 15) for h ✓ $p=-1$ ✓ $q=-3$ (3)
4.5	$y=2x+4$ $x=2y+4$ $\therefore y=\frac{1}{2}x-2$	✓ swop x and y ✓ $y=\frac{1}{2}x-2$ (2)
4.6	$g(x)=0$ or $g^{-1}(x)=0$ $x=4$ or $x=-2$ (product 0 at x-intercepts)	✓ $x=4$ ✓ $x=-2$ (2)
		[13]
Question 5		
5.1	$y>0$ **OR** $y\in(0\,;\,\infty)$	✓ answer **OR** ✓ answer (1)
5.2	f: $y=3^x$ f^{-1}: $x=3^y$ $y=\log_3 x$	✓ $x=3^y$ ✓ equation (2)
5.3	$y=\log_3 x$ $2=\log_3 a$ $a=3^2=9$	✓ correct subst into correct formula $(a\,;\,2)$ ✓ answer (2)

5.4		For f ✓ shape ✓ y-intercept & a point ✓ axis of symmetry/ y=x For f^{-1} ✓ shape ✓ x-intercept & a point (5)
5.5	Yes. The vertical line test cuts f^{-1} once **OR** Yes. For every x – value there is a unique y – value **OR** Yes. f is a one-to-one function	✓ yes (2) ✓ valid reason **OR** ✓ yes ✓ valid reason (2) **OR** ✓ yes ✓ valid reason (2)
		[12]
Question 6		
6.1.1	$y^2 = \sqrt{(13)^2 - (-5)^2}$ [Pythagoras] $y = -12$  $sin^2\theta$ $= \left(-\frac{12}{13}\right)^2$ $= \frac{144}{169}$ OR $sin^2\theta = 1 - cos^2\theta$	✓ y = -12 ✓ substitution ✓ answer (3) ✓ square identity

	$sin^2\theta = 1 - \left(-\frac{5}{13}\right)^2$ $sin^2\theta = \frac{144}{169}$	✓ substitution ✓ answer (3)
6.1.2	$\cos(\theta - 135°)$ $= cos\theta cos135° + sin\theta sin135°$ $= cos\theta(-cos45°) + sin\theta(sin45°)$ $= \left(-\frac{5}{13}\right)\left(-\frac{\sqrt{2}}{2}\right) + \left(-\frac{12}{13}\right)\left(\frac{\sqrt{2}}{2}\right)$ $= -\frac{7\sqrt{2}}{26}$ *OR* $\left(-\frac{5}{13}\right)\left(-\frac{1}{\sqrt{2}}\right) + \left(-\frac{12}{13}\right)\left(\frac{1}{\sqrt{2}}\right)$ $-\frac{7}{13\sqrt{2}}$	✓expansion ✓ reduction ✓ substitution ✓ answer (4)
6.2	$LHS = 2cos^2(45° + x)$ $= 2cos^2(45° + x) + 1 - 1$ $= \cos[2(45° + x)] + 1$ $= \cos(90° + 2x) + 1$ $= (-sin2x) + 1$ $= 1 - sin2x$ RHS OR $LHS = 2cos^2(45° + x)$ $= 2(\cos(45° + x))^2$ $= 2(cos45°cosx - sin45°sinx)^2$ $= 2\left(\frac{\sqrt{2}}{2}cosx - \frac{\sqrt{2}}{2}sinx\right)^2$ $= 2\left(\frac{1}{2}cos^2x - sinxcosx + \frac{1}{2}sin^2x\right)$ $= cos^2x - 2sinxcosx + sin^2x$ $= 1 - sin2x$ $= RHS$	✓ +1 – 1 ✓ double angle ✓ simplify ✓ reduction (4) ✓ compound expansion ✓ subst special angle ✓ simplification ✓ square identity (4)
6.3.1	$LHS = \sin(A - B) - \sin(A + B)$ $= sinAcosB - cosAsinB - (sinAcosB + cosAsinB)$ $= sinAcosB - cosAsinB - sinAcosB - cosAsinB$ $= -2cosAsinB$ $= RHS$	✓ $sinAcosB - cosAsinB$ ✓$-sinAcosB - cosAsinB$ (2)
6.3.2	$sin4x - sin10x$ $= \sin(7x - 3x) - \sin(7x + 3x)$ $= -2cos7xsin3x$	✓ $7x - 3x$ & $7x + 3x$ ✓ answer (2)

6.3.3	$\sin 4x - \sin 10x = \sin 3x$ $-2\cos 7x \sin 3x = \sin 3x$ $2\cos 7x \sin 3x + \sin 3x = 0$ $\sin 3x\,(2\cos 7x + 1) = 0$ $\sin 3x = 0$ *or* $\cos 7x = -\frac{1}{2}$ $3x = 0°$ $7x = 120°$ *or* $7x = 240°$ $x = 0°$ $x = 17{,}14°$ $x = 34{,}29°$(N/A)	✓ substitution ✓ factorisation ✓ both equations ✓ answer ✓answer (5)
		[20]
Question 7		
7.1.1	180°	✓ answer (1)
7.1.2	1	✓ answer (1)
7.2	$1 - 2sin^2x = -\sin x$ $2sin^2x - sinx - 1 = 0$ $(2sinx + 1)(sinx - 1) = 0$ $sinx = -\frac{1}{2}$ or $sinx = 1$ Ref $\angle = 30°$ ref $\angle = 90°$ $x = 210° + k.360°$ $x = 90° + k.360°$ Or $x = 330° + k.360°$ $x = -150°$ or $x = -30°$ or $x = 90°$ OR $cos2x = -sinx$ $cos2x = \cos(90° - x)$ $2x = 180° - (90° - x) + k.360°$ or $2x = 180° + (90° - x) + k.360°$ $2x = 90° + x + k.360°$ or $2x = 270° - x + k.360°$ $x = 90° + k.360°$ or $x = 90° + k.120°$ $= -150°$ or $x = -30°$ or $x = 90°$ OR $cos2x = -sinx$ $cos2x = \cos(90° + x)$ $2x = 90° + x + k.360°$ or $2x = 360° - (90° + x) + k.360°$ $x = 90° + k.360°$ or $3x = 270° + k.360°$ $x = 90° + k.120°$ $x = -150°$ or $x = -30°$ or $x = 90°$	✓ identity ✓ factors ✓ $sinx = -\frac{1}{2}$ ✓ $sinx = 1$ ✓$-150°$ and $-30°$ (6) ✓ 90° ✓ co-function ✓ $2x$ in quadrant 2 ✓ $2x$ in quadrant 3 ✓ both general solutions ✓$-150°$ and $-30°$ ✓ 90° (6) ✓ co-function ✓ $2x$ in quadrant 1 ✓ $2x$ in quadrant 4 ✓ both general solutions ✓$-150°$ and $-30°$ ✓ 90° (6)

	OR $cos2x = -sinx$ $\sin(90° - 2x) = -sinx$ $90° - 2x = 180° + x + k.360°$ or $90° - 2x = 360° - x + k.360°$ $x = -30° + k.120°$ or $x = -270° + k.360°$ $= -150°$ or $x = -30°$ or $x = 90°$	✓ co-function ✓ $90° - 2x$ in quadrant 3 ✓ $90° - 2x$ in quadrant 4 ✓ both general solutions ✓ $-150°$ and $-30°$ ✓ $90°$ (6)
7.3	$A(-150°; 0,5)$ $B(-30°; 0.5)$ AB = $-30° - (-150°)$ AB = $120°$	✓ AB = $-30° - (-150°)$ ✓ answer (2)
		[10]
Question 8		
8.1.1	$\frac{AC}{20} = \cos 30°$ $AC = 20\cos 30°$ $AC = 10\sqrt{3} = 17,32\ units$ OR $\frac{AC}{\sin 60°} = \frac{20}{\sin 90°}$ $\therefore AC = 20\sin 60° = 17,32\ units$	✓ trig ratio ✓ answer (2) ✓ trig ratio ✓ answer (2)
8.1.2	$AB^2 = AC^2 + BC^2 - 2AC.BCcos\ A\hat{C}B$ $AB^2 = \left(10\sqrt{3}\right)^2 + (8)^2 - 2(10\sqrt{3})(8)Ccos\ 100°$ $AB = 20,30\ units$	✓ cosine formula ✓ substitution into cosine formula ✓ answer (3)
8.2	$\frac{\sin A\hat{D}B}{AB} = \frac{\sin A\hat{B}D}{AD}$ $\frac{\sin A\hat{D}B}{20,3} = \frac{\sin 73,4°}{20}$ $\sin A\hat{D}B = \frac{\sin 73,4°}{20}$ $A\hat{D}B = 76,58°$	✓ sine formula in ΔABD ✓ substitution in the sine formula ✓ answer (3) **[8]**
		TOTA L: 100