WTS TUTORING

2021 MATHEMATICS

GRADE 11

WTS TERM TWO CAMP

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REGISTRATION NUMBER: 149 – 892 NPO

2021 WTS TERM TWO CAMP

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PROVINCE	: KWAZULU NATAL
VENUE	: DURBAN: ADAMS COLLEGE
GRADE	: 08 TO 12
PRICE	: R2000 [FOOD +ACCOMMODATIONS + LESSONS]
DATE	: 25 APRIL TO 01 MAY 2021
TIME	: 08:00 TO 23:00 DAILY

TRANSPORT ARRANGEMENTS: 078 380 6604 / 078 566 4337

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➢ PAPER ONE

KWV 01

QUESTION 3

3.1 Write down the next TWO terms of the quadratic sequence:

5 ; 10; 17 ;… (2)

3.2 The first four terms of a quadratic sequence are

$(x-3)$; $(-2x+2)$; $(3x+11)$ and $(4x+12)$.

Calculate the value of x. (4)

3.3 Consider the quadratic pattern: 3 ; 7 ; 13 ; 21 ; …

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

3.3.2 Which term of the pattern will be the first to exceed 463? (4)

3.3.3 Between which TWO consecutive terms in the sequence is the first difference equal to 102? (4)

3.3.4 Consider the number pattern:

Row 1: 3
Row 2: 5 7
Row 3: 9 11 13
Row 4: 15 17 19 21

Calculate the number at the end of the 60^{th} row. (3)

3.4 The following is a linear pattern: 6 ; p ; q ; r ; 42 ; …

Determine the values of p, q and r. (4)

[25]

QUESTION 4

The hyperbola, *f*, is defined by $f(x)=\dfrac{3}{x-2}+1$.

4.1 Write down the equations of the asymptotes of *f*. (2)

4.2 Write down the *y*-intercept of *f*. (1)

4.3 Determine the *x*-intercept of *f*. (2)

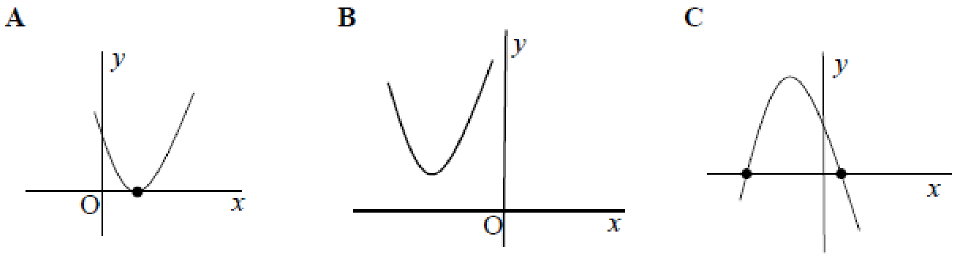
4.4 Sketch the graph of f, showing all intercepts with the axes and any asymptotes. (3)

4.5 Write down the domain of h, if $h(x)=f(x-2)$. (2)

[10]

QUESTION 5

5.1 The following are graphs defined by $y=ax^2+bx+c$.



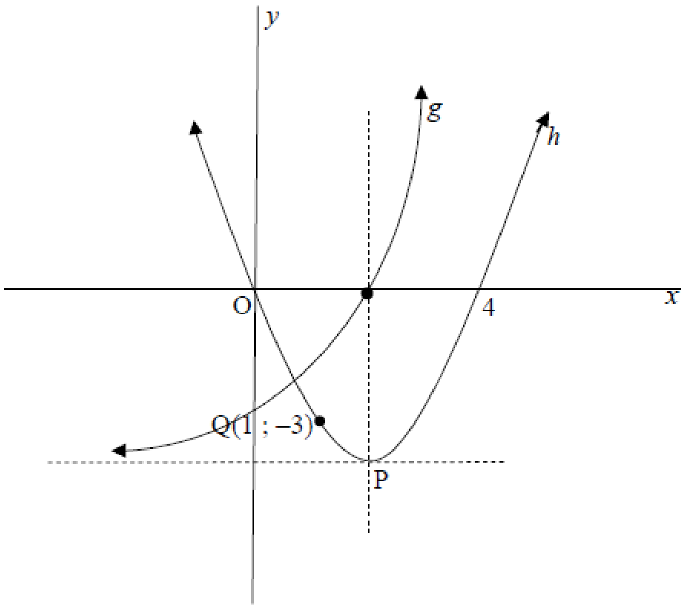
Match each of the following statements below with an associated graph above.
You must only write down the letter of the corresponding graph.

5.1.1 $b^2-4ac>0$ (1)

5.1.2 $b^2-4ac=0$ (1)

5.1.3 $b^2-4ac<0$ (1)

5.2 The sketch below shows the graphs of $y = k^x + t$ and $y = ax^2 + bx + c$.
The x-intercepts of h are (0 ; 0) and (0 ; 4). Q(1 ; –3) is a point on h.
The horizontal line through P, the turning point of h, is the asymptote of g.
The x-intercept of g lies on the axis of symmetry of h.



5.2.1 Show that $a = 1$ and $b = -4$. (3)

5.2.2 Determine the coordinates of P, the turning point of h. (2)

5.2.3 Write down the range of h. (1)

5.2.4 Write down the value of t. (1)

5.2.5 Hence, calculate the value of k. (2)

5.2.6 For which value(s) of r will the roots of $x^2 - 4x + r$ be non-real? (2)

[14]

QUESTION 6

Given the functions $p(x) = -2x^2 - 5x + 3$ and $q(x) = mx + 3$.
The angle of inclination of q is $135°$.

6.1 Determine the intercepts of p with the x and y axes. (3)

6.2 Determine the coordinates of the turning point of p. (2)

6.3 Write down the value of m, the gradient of q. (1)

6.4 Sketch the graphs of p and q on the same set of axes. Clearly indicate ALL the intercepts with the axes as well as the coordinates of the turning point. (5)

6.5 Determine the value of k for which the straight line $y = -x + k$ will be a tangent to p. (3)

[14]

KWV 2

QUESTION 4

4.1 Consider the quadratic number pattern: 0 ; –9 ; –16 ; –21 ; –24

4.1.1 Determine the n^{th} term (T_n) of the pattern. (4)

4.1.2 Calculate the 30^{th} term of the pattern. (2)

4.1.3 Determine which term of the pattern will be equal to 200. (4)

4.2 The first three figures in a pattern of grey and white squares are shown below.

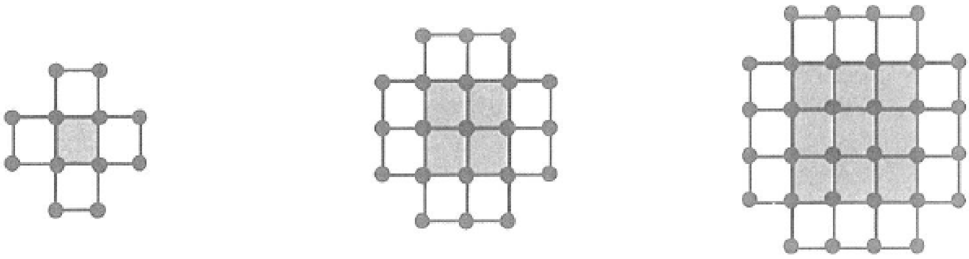


Figure 1 Figure 2 Figure 3

4.2.1 Considering Figure 4 in the pattern, determine:

(a) The number of grey squares in this figure. (1)

(b) The number of white squares in this figure. (1)

(c) The number of dots in this figure. (1)

4.2.2 Considering the n^{th} figure, determine an expression in terms of n for:

(a) The number of grey squares. (1)

(b) The number of white squares. (1)

(c) The number of dots. (2)

4.2.3 There are 320 dots in one of the figures. Determine the number of grey squares in this figure. (5)

[22]

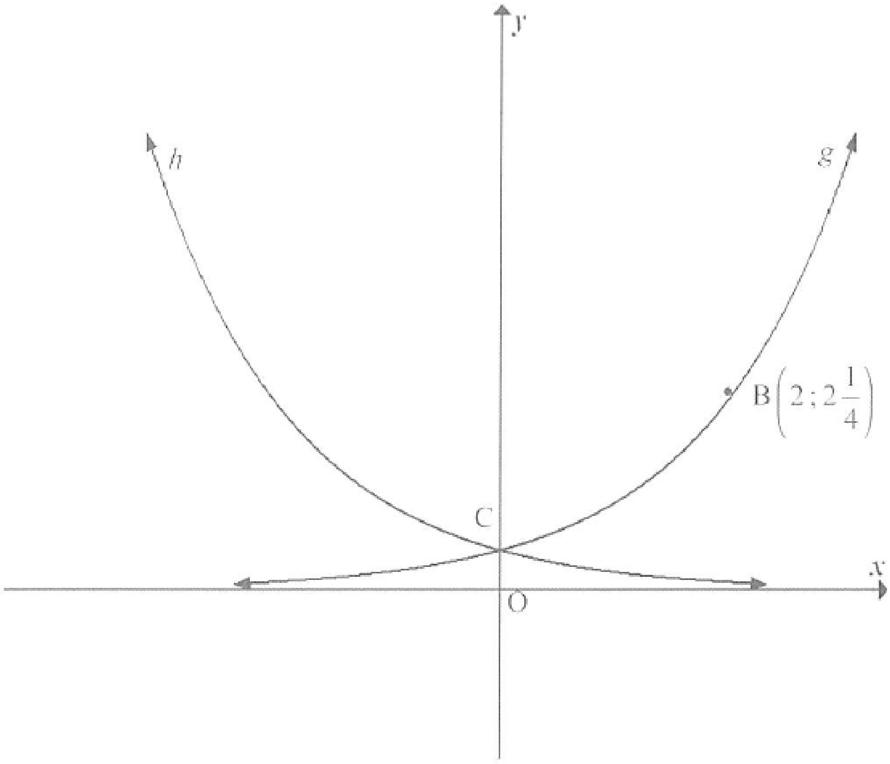
QUESTION 5

5.1 Given: $f(x) = \frac{-6}{x+3} + 2$.

5.1.1 Draw a neat sketch graph of f, indicating the asymptote(s) and intercept(s) with the axes. Show all your calculations. (6)

5.1.2 An axis of symmetry of f has the equation $y = mx + 5$. Write down the value of m. (1)

5.2 In the diagram below, g represents the function $g(x) = a^x, a > 0$. The graph h is symmetrical to g about the y – axis. The point $B\left(2; 2\frac{1}{4}\right)$ lies on the curve of g and C is the y-intercept of both g and h.



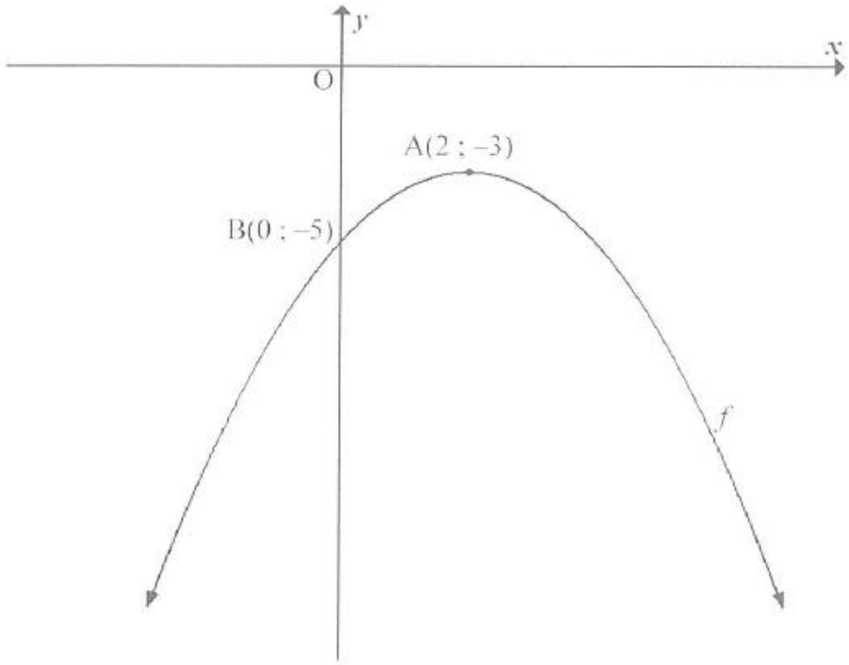
5.2.1 Write down the range of g. (1)

5.2.2 Calculate the value of a. (2)

5.2.3 Determine the equation of h in the form $y = b^x$. (2)

5.2.4 B′ is the reflection of B in the y-axis. Calculate the average gradient between B′ and C. (4)

5.3 The diagram below shows the graph of a parabola f, with turning point A(2 ; –3) and y – intercept B(0 ; –5).



5.3.1 Show that the equation of the parabola can be written as $y = -\frac{1}{2}x^2 + 2x - 5$. (5)

5.3.2 Use the graph to determine the value(s) of k for which the equation $-\frac{1}{2}x^2 + 2x - 5 = k$ will have real and unequal roots. (2)

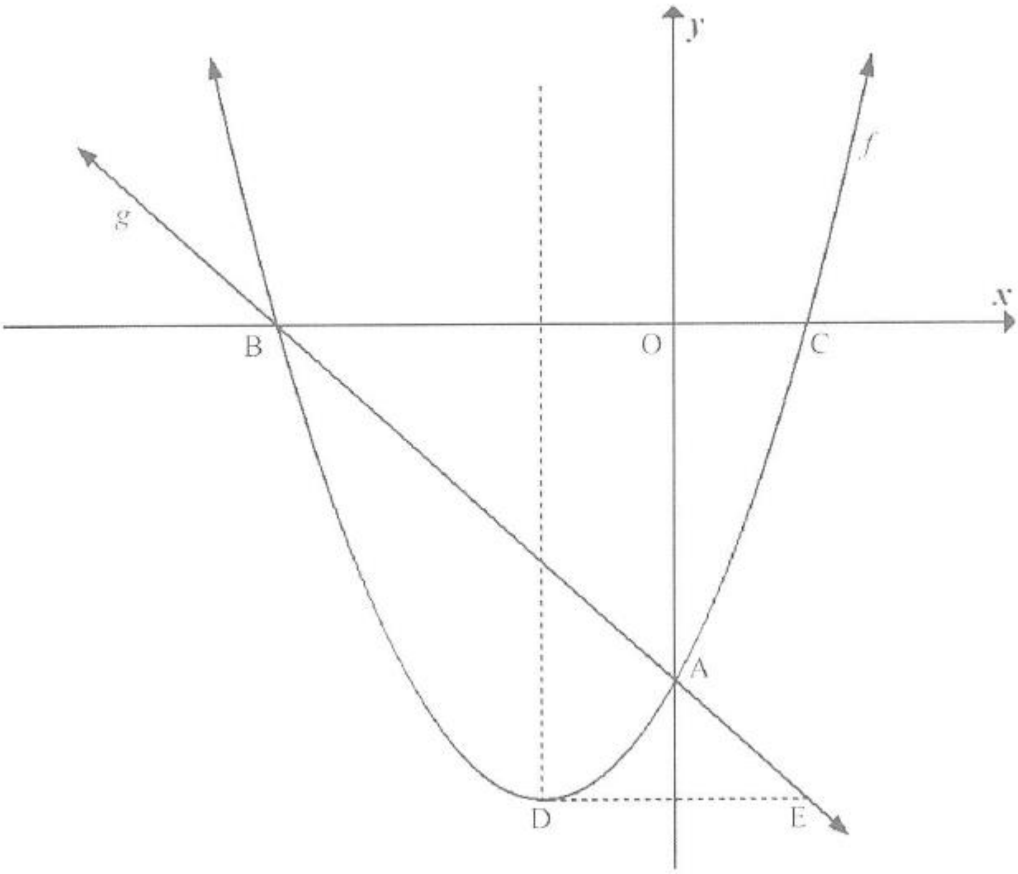
5.3.3 The parabola f is shifted vertically until the new y – intercept is at the origin. Determine the new turning point of the parabola. (2)

[25]

QUESTION 6

The diagram below represents the functions: $f(x) = \frac{3}{2}x^2 + 3x - \frac{9}{2}$ and $g(x) = mx + c$.

- A, B and C are the points at which f intersects the axes.
- D is the turning point of f.
- g passes through A and B.
- E is a point on g.



6.1 Determine the coordinates of A, B and C. (5)

6.2 Determine the coordinates of D. (3)

6.3 Use the graphs to determine the values of x for which $f(x) \geq g(x)$. (2)

6.4 Determine the equation of g in the form $g(x) = mx + c$. (3)

6.5 Determine the length of DE, if DE is perpendicular to the y-axis. (4)

[17]

KWV 03

QUESTION 3 **[18]**

3.1 Given the sequence $-3 ; 1 ; 5 ; ...$

3.1.1 Write down the 5^{th} term of the sequence. (1)

3.1.2 Determine the general term of this sequence. (2)

3.1.3 Show that 394 is NOT a term in the sequence. (3)

3.2 The quadratic sequence $0 ; 5 ; 12 ; ...$ has the general term, $T_n = n^2 + 2n + c$.

3.2.1 Show that $c = -3$. (2)

3.2.2 Calculate the 10^{th} term of the sequence. (2)

3.2.3 Determine which term in the sequence has a value greater than 360. (4)

3.3 The table below represents the total number of handshakes exchanged between random people.
Each person shakes the hand of another person only once.

Number of people	2	3	5	100
Number of handshakes	1	3	a	b

3.3.1 Determine the value of a. (1)

3.3.2 Determine the value of b. (3)

QUESTION 5 **[12]**

Given: $h(x) = 3^x - 1$

5.1 Determine the x and y-intercepts of h. (3)

5.2 Sketch the graph of h on the ANSWER SHEET provided on page 7. Clearly indicate the points of intersection with the axes as well as the asymptote of the graph. (3)

5.3 Write down the range of h. (1)

5.4 Given: $p(x) = h(x+2)$

5.4.1 Determine the x-intercept of p. (1)

5.4.2 Determine for which value(s) of x is $p(x) > 2$. (1)

5.5 Determine the x coordinate of a point J on h if

$3h(x) = 726$. (3)

QUESTION 6 **[10]**

Given the function $f(x) = \frac{3}{x-1} - 2$.

6.1 Write down the equations of the asymptotes of f. (2)

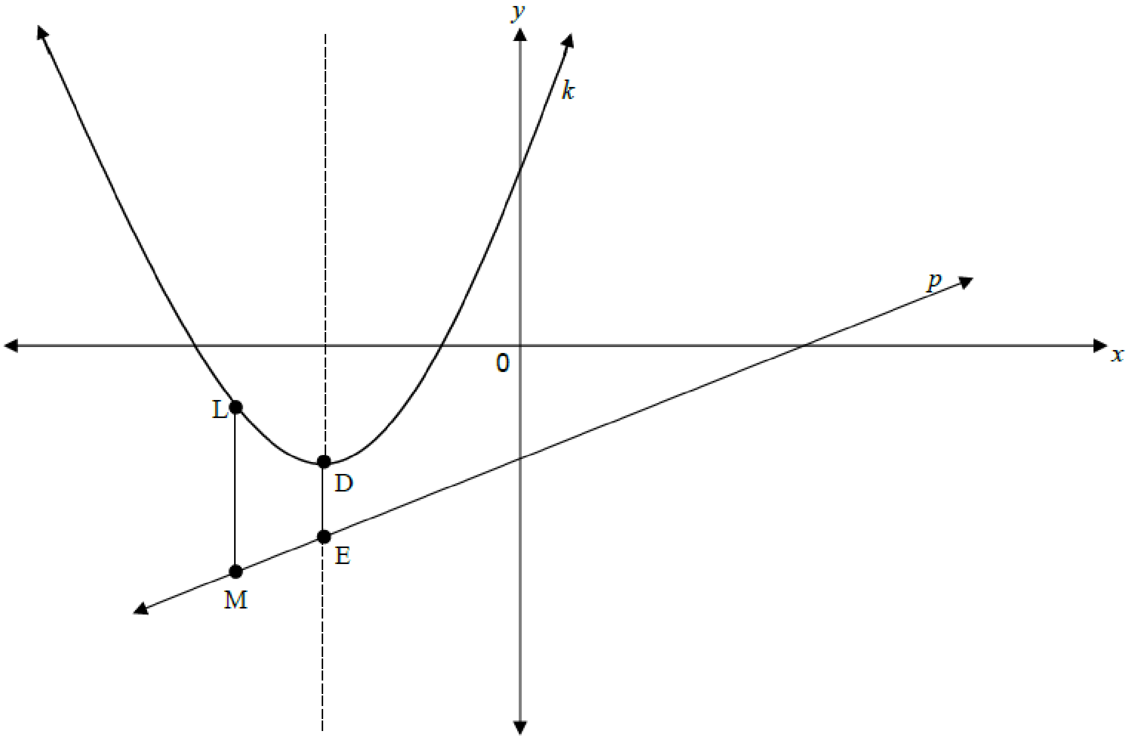
6.2 Calculate the x and y-intercepts of the graph with the axes. (3)

6.3 Sketch the graph of f on the answer sheet provided on page 7, clearly illustrating the asymptotes and the intercepts of the graph with the axes. (3)

6.4 Describe, in words, the transformation of f to g if $g(x) = \frac{-3}{x+1} - 2$. (2)

QUESTION 7 **[20]**

The graphs of $k(x) = 2x^2 + 8x + 3$ and $p(x) = 2x - 4$ are sketched below.



7.1 Determine

7.1.1 the coordinates of point D, the turning point of k. (3)

7.1.2 for which values of x is $k(x) \geq 3$. (2)

7.1.3 the minimum length of LM, where LM is parallel to the y- axis, with points L on k and M on p respectively. (4)

7.1.4 the average gradient between $k(-2)$ and $k(3)$. (3)

7.1.5 the value of t such that the straight line, $y = 2x + t$, touches the graph of $k(x) = 2x^2 + 8x + 3$ only ONCE. (5)

7.2 A quadratic function f has $f(1\frac{1}{2}) = 0$, $f(-4) = 0$ and $f(1) = -5$.
Draw a sketch graph of f in your ANSWER BOOK. (3)

QUESTION 3

3.1 The following sequence of numbers is given:

2; 7; 12; 17; ....

3.1.1 Write down the values of the next two terms of the sequence. (2)

3.1.2 Write down the value of the first term in the sequence that will have a value that is greater than 107. (1)

3.1.3 Determine an expression for the n^{th} term of the sequence. (2)

3.1.4 Which term of the sequence will be equal to 182? (2)

3.1.5 The terms of this sequence are also the first differences of a certain quadratic sequence. If the fourth term of this quadratic sequence is 22, write down its first, second and third terms. (3)

3.2 Given the following quadratic sequence:

51; 70; 95; 126; ....

3.2.1 Write the value of the next term of the sequence. (2)

3.2.2 Determine an expression for the n^{th} term of this quadratic sequence. (5)

3.2.3 Which term of the sequence will be equal to 4063? (4)

[21]

QUESTION 4

4.1 Given $f(x) = -x^2 - 2x + 3$.

4.1.1 Write f in the form $y = a(x+p)^2 + q$. (3)

4.1.2 Draw a neat sketch graph of f on the **DIAGRAM SHEET** provided.

Indicate all intercepts with the axes and the coordinates of the turning point. (5)

4.1.3 Write down the range of f. (2)

4.1.4 Describe the transformation from f to h if $h(x) = x^2 + 2x - 3$ (2)

4.1.5 On the same set of axes as f, draw a neat sketch graph of g if $g(x) = -2x + 2$, showing all intercepts with the axes. (2)

4.1.6 Now use your graphs to answer the following questions:

For which value(s) of x is:

(a) $f(x) - g(x) = 0$? (2)

(b) $f(x) > 0$? (2)

4.2 Draw a rough sketch graph of $k(x) = ax^2 + bx + c$, if it is given that

- k has no real roots;
- $b > 0$ and
- $c > 0$. (3)

[21]

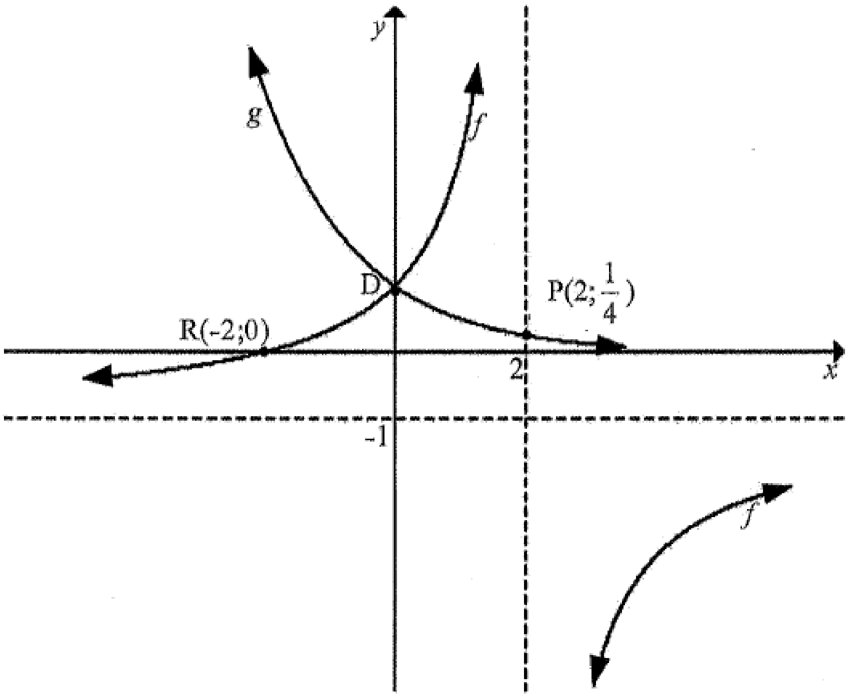
QUESTION 5

The diagram below represents the graphs of $f(x) = \dfrac{a}{x+p} + q$ and $g(x) = t^x$.

f cuts the x-axis at $R(-2;0)$ and the y-axis at D.

$P\left(2;\dfrac{1}{4}\right)$ is a point on the graph of g.

f and g intersect at point D.



5.1	Write down the values of p and q.	(2)
5.2	Determine the value of a.	(3)
5.3	Determine the value of t.	(3)
5.4	Calculate the average gradient of g between $x = -2$ and $x = 2$.	(3)
5.5	Write down the equation of the asymptote of g.	(1)
5.6	Write down the coordinates of D.	(2)
5.7	Determine the equation of the axis of symmetry of f that has a negative gradient.	(3)
5.8	Point D is reflected in the line determined in 5.7 to give point E. Write down the coordinates of E.	(2)

[19]

KWV 05

QUESTION 3

3.1 Consider the sequence

$-3;\ 2;\ 7;\ 12;\ \ldots\ldots\ldots\ldots$

3.1.1 Write down the next **2** terms of the sequence. (2)

3.1.2 Determine the formula for the n^{th} term of the sequence. (2)

3.2 Determine the value of x if **1; 7; 19;** x**; 61**.........is a quadratic sequence. (2)

3.3 **16; 33; 56; 85;** .... forms a quadratic sequence.

3.3.1 Write down the next term in the pattern. (1)

3.3.2 Determine the n^{th} term of the sequence. (4)

3.3.3 Which term of the sequence has a value of **2080?** (4)

3.3.4 **6; 23; 46; 75**...... continues in the same pattern as the one above.

Write down the formula for the n^{th} term of this sequence. (2)

[17]

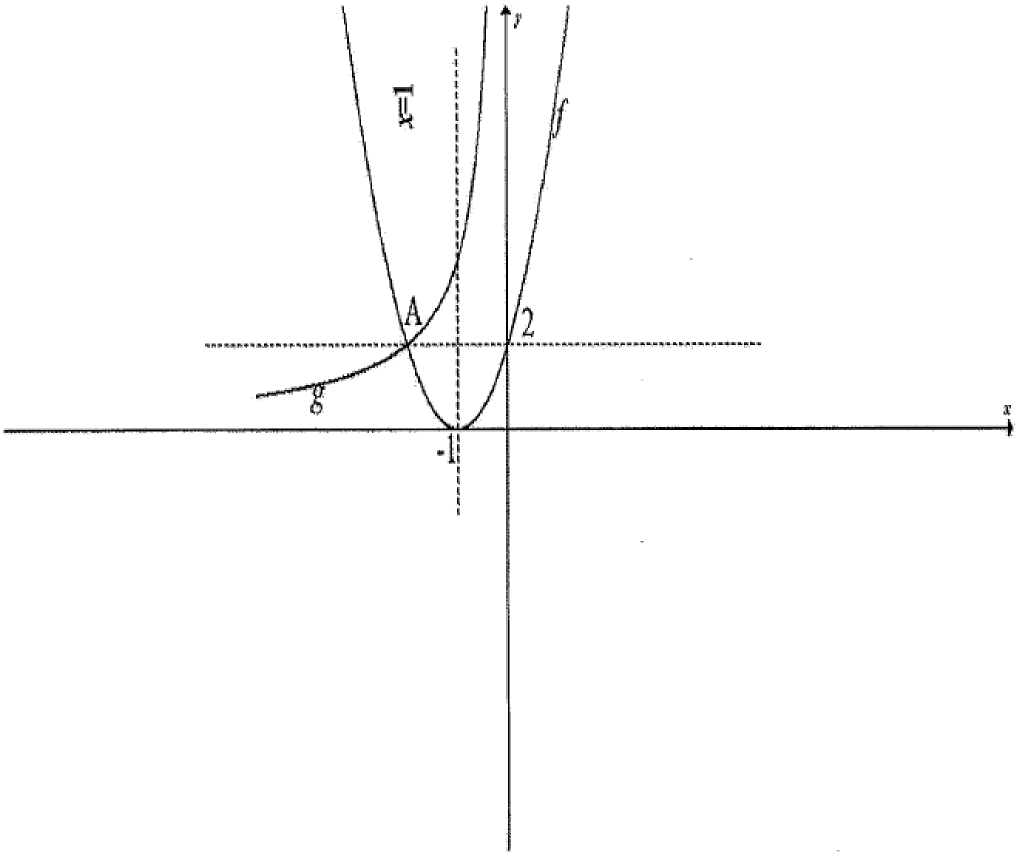
QUESTION 4

4.1 The sketch below shows the sketch of;

$f(x) = ax^2 + bx + c$, with the line of symmetry $x = -1$

$g(x) = \frac{k}{x}$; $x < 0$

and the line $y = 2$. The curves of f and g and the line $y = 2$ intersect at A.



4.1.1 Write down the co-ordinates of A. (1)

4.1.2 Show that $a = 2$, $b = +4$ and $c = 2$ (4)

4.1.3 Determine the equation of g. (3)

4.1.4 Write down the equations of the line of symmetry of g. (2)

4.1.5 For what values of x is f increasing? (1)

4.1.6 Determine the average gradient on the curve of f between $x = -1$ and $x = 0$ (2)

4.1.7 If the graph of f is shifted **2 units** to the **right** and **3 units down,** write down the equation of the new graph. (2)

[15]

4.2 Given $y = -2x^2 + 8x + 10$ and $y = -2x - 2$

4.2.1 Determine the x and y intercepts of $y = -2x^2 + 8x + 10$ (4)

4.2.2 Sketch both graphs on the system of axes provided. (6)

4.2. 3 Determine the coordinates of the points of intersection of the two graphs. (2)

[12]

QUESTION 5

Consider the following functions;

$$g(x) = \frac{3}{x-2} + 1$$

$$h(x) = 3^{x-2} - 1$$

5.1 State the x and y intercepts of g. (2)

5.2 Write down the y asymptote of h. (2)

5.3 State the range for g (2)

5.4 Sketch both graphs on the system of axes provided. (6)

[12]

KWV 06

QUESTION 3 **[20]**

3.1 Consider the following number pattern:

$$1; -3; \ -9; \ -17; \dots$$

3.1.1 Write down the next 2 terms of the sequence. (2)

3.1.2 Determine the general term for the number pattern. (4)

3.1.3 Determine the value of the 30^{th} term in the number pattern. (2)

3.1.4 Which term in the pattern will have a value of -7479? (3)

3.2 Consider the following continuous pattern below that emerges when odd numbers are added.

$$1 = 1$$

$$1 + 3 = 4$$

$$1 + 3 + 5 = 9$$

$$1 + 3 + 5 + 9 + 7 = 16$$

Hence calculate the value of the pattern:

$$1 + 3 + 5 + 7 + \ \dots \ + 1001$$ (6)

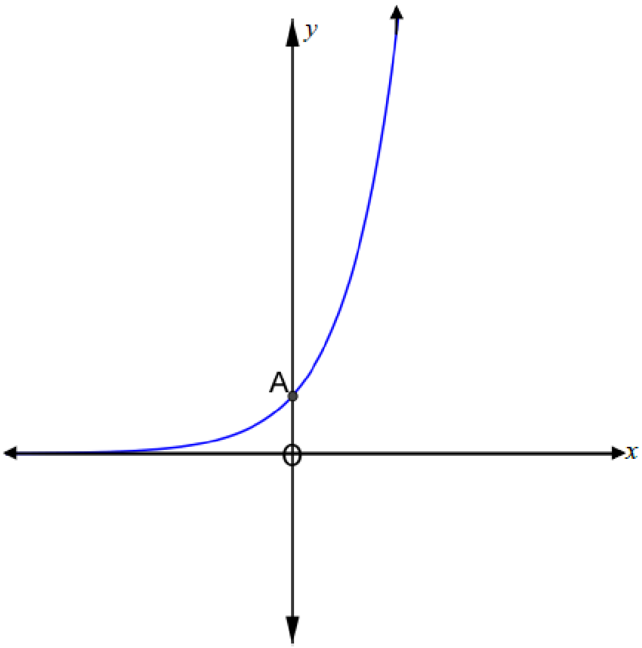
3.3 A grade 10 Mathematics test consists of 100 multiple choice questions. A candidate answers $5n - 2$ of these questions in the designated time.

How many questions did the candidate answer? (3)

QUESTION 4 **[10]**

The graph of $f(x) = 3^x$, is drawn below with $x \in \mathbb{R}$.

Point A is the y-intercept of the graph.



4.1 Write down the coordinates of point A. (2)

4.2 A new graph g is formed when the graph of f is reflected in the y-axis.

4.2.1 Write down the equation of g. (2)

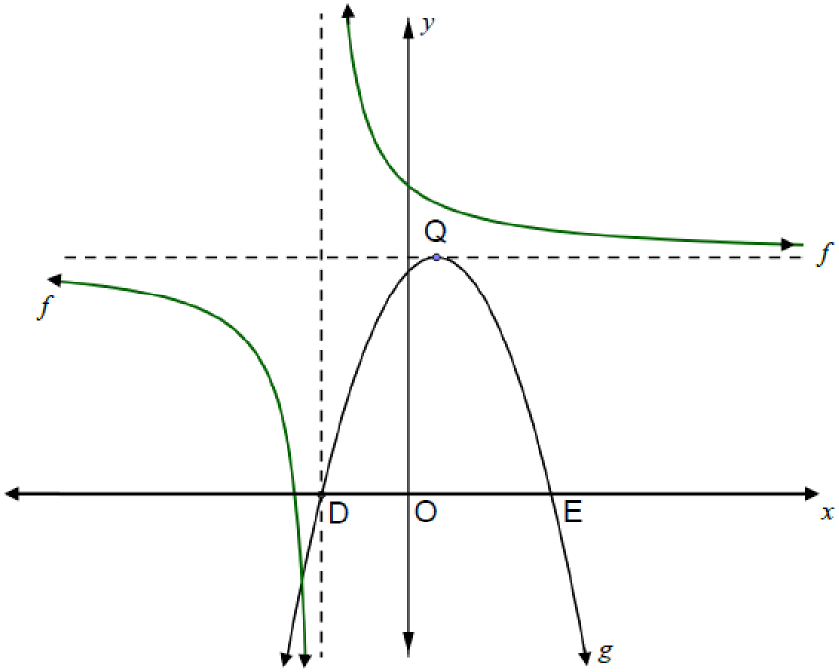
4.2.2 Sketch the graph of g in your ANSWER BOOK. Clearly indicate all intercepts with the axes. (3)

4.3 The graph of $k(x) = 3^{-x+1} + 2$ is formed as the result of a transformation of the graph of f.

Describe the transformation of the graph of f to the graph of k. (3)

QUESTION 5 **[20]**

The graphs of $g(x) = -2x^2 + 4x + 16$ and $f(x) = \frac{12}{x+p} + q$ are drawn below.
Point Q is the turning point and point D and point E are the x- intercepts of g.
The horizontal and vertical asymptotes of f intersect the graph of g at point Q and point D respectively.



5.1 Show that g can be represented by the equation $g(x) = -2(x-1)^2 + 18$. (4)

5.2 Hence, or otherwise, determine the coordinates of point Q. (2)

5.3 Calculate the coordinates of point D and point E. (4)

5.4 Determine the equations of the asymptotes of f and state the value of p and q. (4)

5.5 Determine for which values of x the graph of g will decrease. (2)

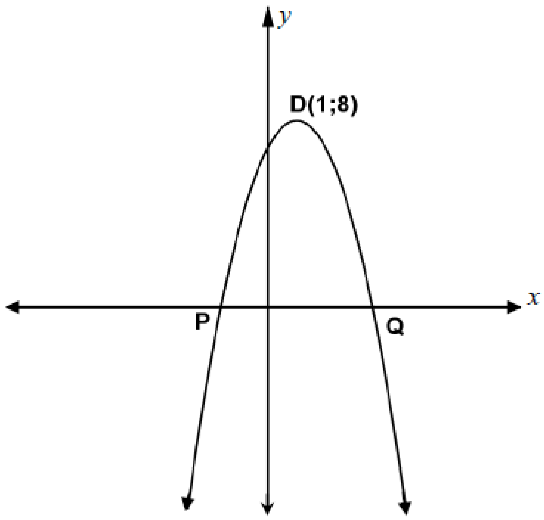
5.6 Write down the range of g. (2)

5.7 Write down the domain of f. (2)

QUESTION 6 [8]

The sketch below represents the graph of $f(x) = -2x^2 + bx + c$, where point D(1 ; 8) is the turning point of f.

The graph of f intersects the x- axis at point P and point Q respectively.



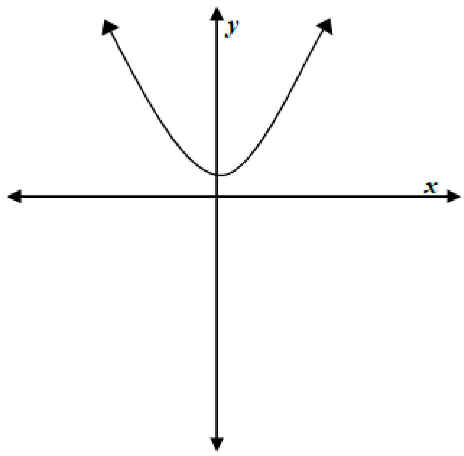
6.1 Determine the values of b and c. (5)

6.2 The graph of g represents f when f is translated 2 units left and 3 units up. Determine the equation of g. (3)

QUESTION 3

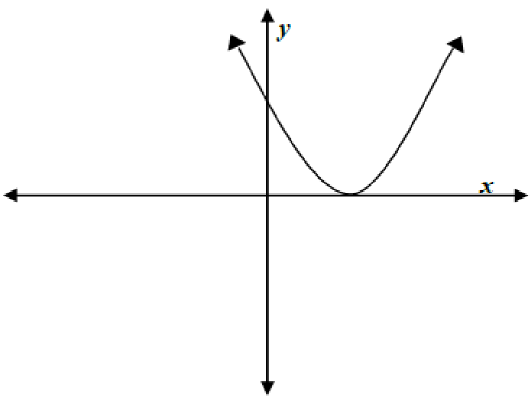
3.1 Determine the nature of the roots of the following graphs.

3.1.1



(2)

3.1.2



(2)

3.2. Show that the roots of the equation $kx^2 + (2k - 1)x = -k + 1$ are rational for all rational value(s) of k. (4)

[8]

QUESTION 4

4.1 $T_k = 3k^2 - 4$ is the k_{th} term of a sequence.

4.1.1 Write down the first THREE terms of the sequence. (3)

4.1.2 Determine the value of k if $T_k = 71$. (3)

4.2 Given the number pattern below:

0; 5; 12; 21; ...

4.2.1 What kind of number pattern is being illustrated? Substantiate your answer. (2)

4.2.2 Determine the general term for this number pattern. (4)

4.3 Study the pattern below:

Row 1: $4^2 - 3^2 + 2^2 - 1^2 = 10$

Row 2: $5^2 - 4^2 + 3^2 - 2^2 = 14$

Row 3: $6^2 - 5^2 + 4^2 - 3^2 = 18$

Row 4: (......................................)

Row 20: (......................................)

Row n : $a^2 - b^2 + c^2 - d^2 = T_n$

4.3.1 Complete the patterns for Row 4 and Row 20. (2)

4.3.2 Determine the values of a; b; c; d; and T_n (in the nth Row) in terms of n.

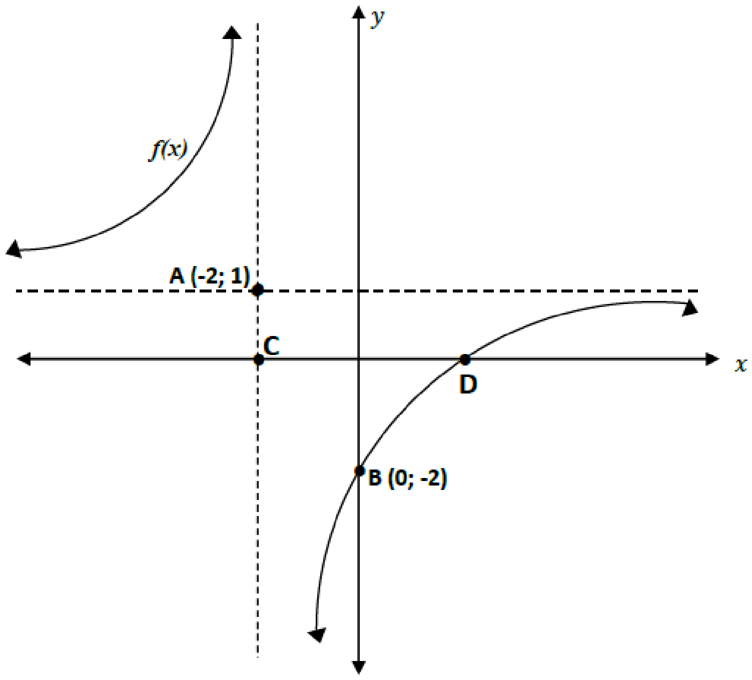
Simplify for T_n as far as possible. (3)

[17]

QUESTION 5

In the diagram below $f(x) = \frac{k}{x-p} + q$ where, A (-2; 1) and B (0;-2) are points on the graph.

It is further given that $g(x) = 2^{x+2}$.



5.1 Derive the equations of the asymptotes of $f(x)$. (2)

5.2 Determine the equation of $f(x)$. (3)

5.3 Calculate the coordinates of Point D. (4)

5.4 Determine the equation of the function $h(x) = ax^2 + bx + c$ which passes through the Points B; C and D where Points C and D are the x-intercepts of the graph. (5)

5.5 On ANSWER SHEET 1, draw a neat sketch of $g(x) = 2^{x+2}$.

Clearly show all the intercepts and asymptotes of the graph. (3)

5.6 Derive the equation of $g(x-3)$. (2)

5.7 Determine the range of $f(x)$. (1)

[20]

QUESTION 6

During the 2015 Cricket World Cup, South African captain AB de Villiers hit the ball with great force. After leaving his bat, the height of the ball, above the ground in metres, after x seconds, is expressed as $h(x) = -x^2 + 4x$.

6.1 Determine the domain of $h(x)$. (2)

6.2 Re-write this equation in the form $h(x) = a(x-p)^2 + q$. (3)

6.3 Sketch the graph of $h(x)$ on ANSWER SHEET 2.

Clearly show all the significant points. (4)

6.4 The graph of $h(x)$ is moved horizontally by five units to the right.

Determine the equation of this new graph in the form of $y = ax^2 + bx + c$. (3)

6.5 Determine the equation for $k(x)$, if $k(x)$ is the reflection of $h(x)$ in the line $x = 0$. (2)

6.6 The average gradient of the graph $p(x) = \frac{1}{2}x^2$ is given as $\frac{p(-3)-p(-1)}{-3-(-1)}$ between the points $x = -3$ and $x = -1$.

Determine the value of the average gradient. (3)

[17]

➢ PAPER TWO

KWV 01

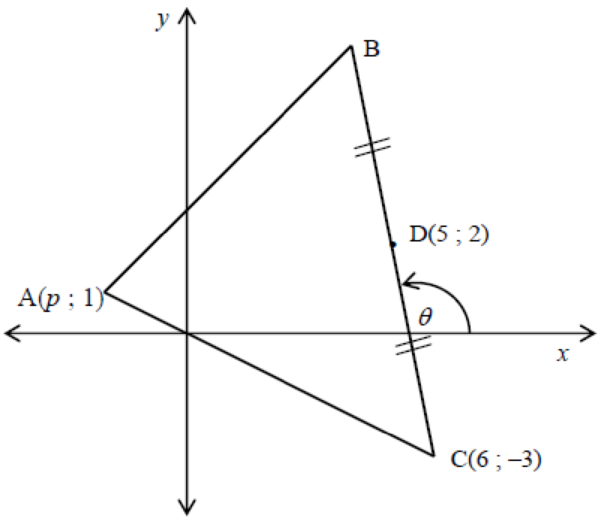
QUESTION 1

1.1 Consider the point K(–8 ; 3) in the Cartesian plane.

1.1.1 Write down the equation of the horizontal line passing through K. (1)

1.1.2 Write down the equation of the vertical line passing through K. (1)

1.2 In the diagram, A(p ; 1), B and C(6 ; –3) are the vertices of Δ ABC.
D(5 ; 2) is the midpoint of BC. A lies in the second quadrant.
DC forms an angle θ with the x-axis.



Determine the:

1.2.1 Gradient of BC. (2)

1.2.2 Size of θ, rounded off to ONE decimal place. (3)

1.2.3 Coordinates of B. (3)

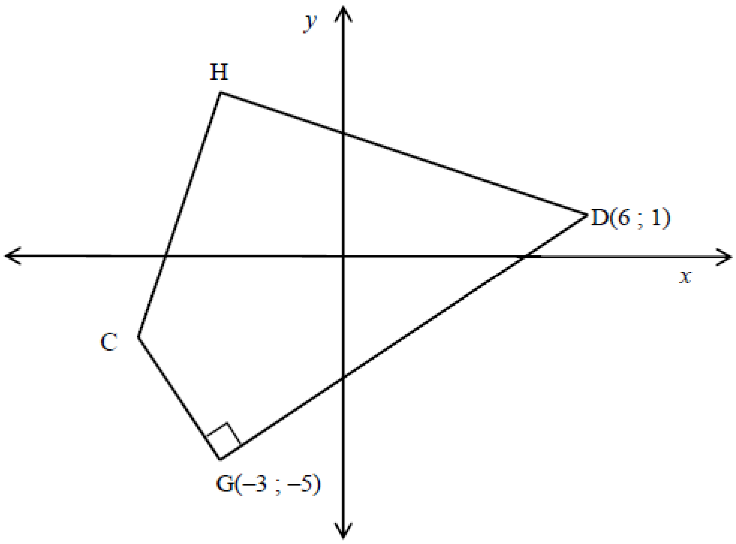
1.2.4 Value of p, if it is given that the length of AC = $4\sqrt{5}$. (5)

[15]

QUESTION 2

2.1 Calculate the value of q if K(–6 ; 9), L(–3 ; q) and M(–2 ; –1) are collinear. (4)

2.2 G(–3 ; –5), D(6 ; 1), H and C are the vertices of quadrilateral GDHC.
CG $\perp$ GD. The equation of CH is $y = 3x + 13$.



2.2.1 Determine the equation of CG. (4)

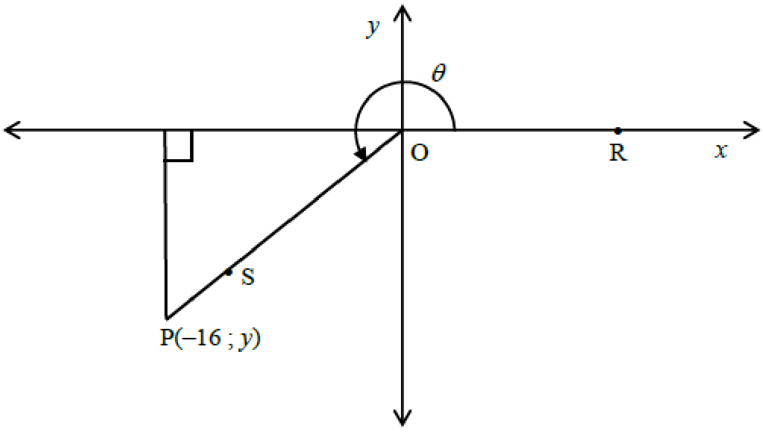
2.2.2 Calculate the coordinates of C. (3)

2.2.3 Calculate the size of $G\hat{C}H$. (5)

[16]

QUESTION 3

3.1 In the diagram below P(–16 ; y) is a point such that OP = 20 units and reflex $R\hat{O}P = \theta$.



3.1.1 Calculate the value of y. (2)

3.1.2 Determine the value of each of the following without using a calculator:

(a) $\sin\left(180^\circ - \theta\right)$ (2)

(b) $\cos\left(180^\circ + \theta\right)$ (2)

3.1.3 S is a point on OP such that OS = 15.
Determine the coordinates of S, WITHOUT using a calculator. (4)

3.2 Simplify, WITHOUT the use of a calculator: $\dfrac{\cos\left(-33^\circ\right).\tan 147^\circ}{2\cos 303^\circ.\sin 240^\circ}$ (7)

[17]

QUESTION 4

4.1 Use trigonometric identities to prove that $\frac{\sin^3 x + \sin x.\cos^2 x}{\cos x} = \tan x$ (3)

4.2 Solve for x if $\sin x = 0,412$ and $x \in [0^\circ \ ; 360^\circ]$. (2)

4.3 Consider the equation: $\tan 3x + 2,64 = 0$.

4.3.1 Determine the general solution of $\tan 3x + 2,64 = 0$ (4)

4.3.2 Hence, or otherwise, solve for x if $-90^\circ \leq x \leq 90^\circ$ (3)

4.4 Solve for x if $4\sin^2 x + 7\cos x - 4 = 0$ and $x \in [0^\circ \ ; 360^\circ]$. (6)

[18]

QUESTION 5

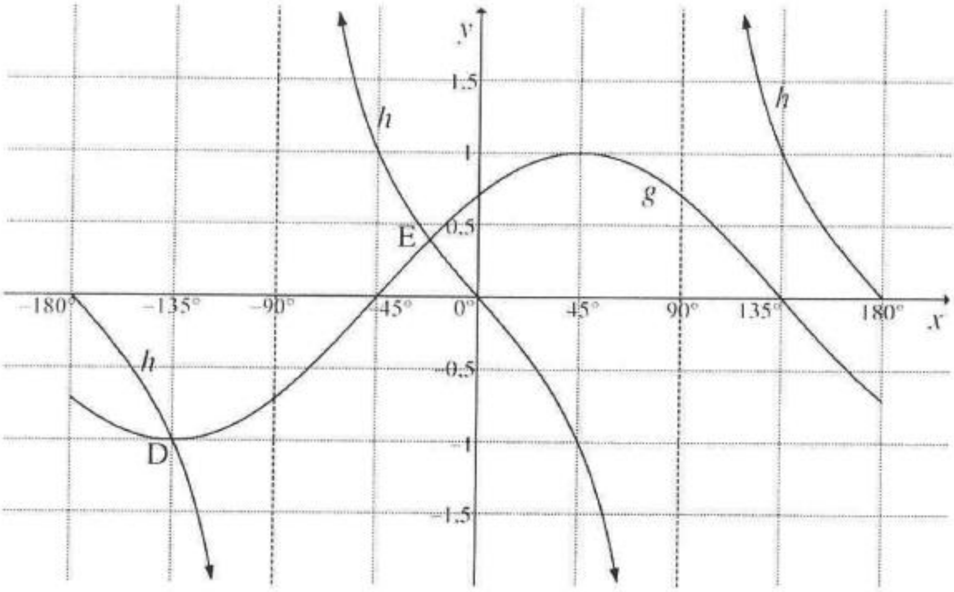
5.1 Given $f(x) = 2\cos 3x$.

5.1.1 Use the grid on DIAGRAM SHEET 2 and draw a sketch graph of f for the interval $x \in [-90° ; 90°]$. Clearly show all intercepts with the axes and turning points of the graph. (3)

5.1.2 Write down the period of f. (1)

5.1.3 Write down the range of f. (1)

5.2 In the diagram below the graphs of $g(x) = \sin(x + a)$ and $h(x) = b\tan cx$ are drawn in the interval $x \in [-180° ; 180°]$. g and h intersect at D and E. The coordinates of D are $(-135° ; -1)$ and the coordinates of E are approximately $(-22{,}3° ; 0{,}4)$.



5.2.1 Write down the values of a, b and c. (3)

5.2.2 Write down the equations of the asymptotes of h in the interval $[-180° ; 180°]$. (2)

5.2.3 Solve for x if $g(x) - h(x) \geq 0$ in the interval $[-180° ; 0°]$. (4)

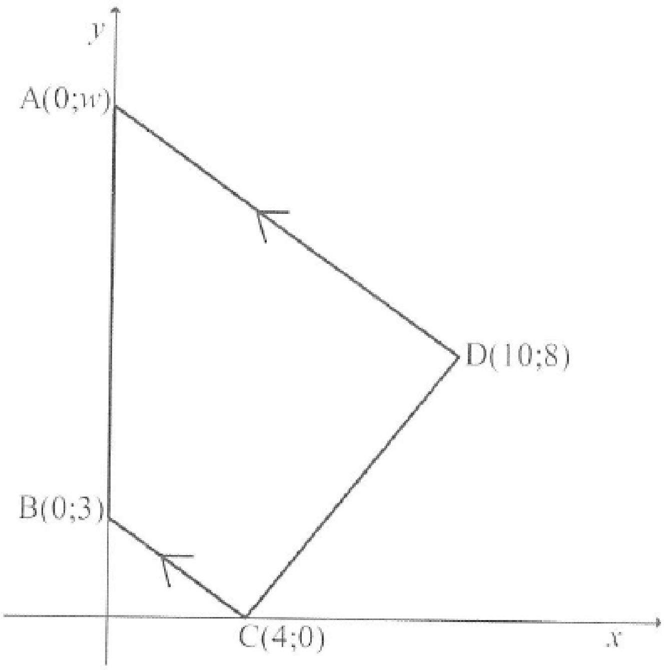
5.2.4 Describe the transformation of g to m if $m(x) = \cos x - 1$. (2)

[16]

KWV 02

QUESTION 1

A(0 ; w), B(0 ; 3), C(4 ; 0) and D(10 ; 8) are the vertices of a quadrilateral in the Cartesian plane. AD is parallel to BC.



1.1

1.1.1 Calculate the gradient of CD. (2)

1.1.2 Hence, determine the angle of inclination of CD. (2)

1.2 Prove that $B\hat{C}D = 90°$. (3)

1.3

1.3.1 Write down the gradient of AD. (1)

1.3.2 Hence, or otherwise, calculate the value of w. (3)

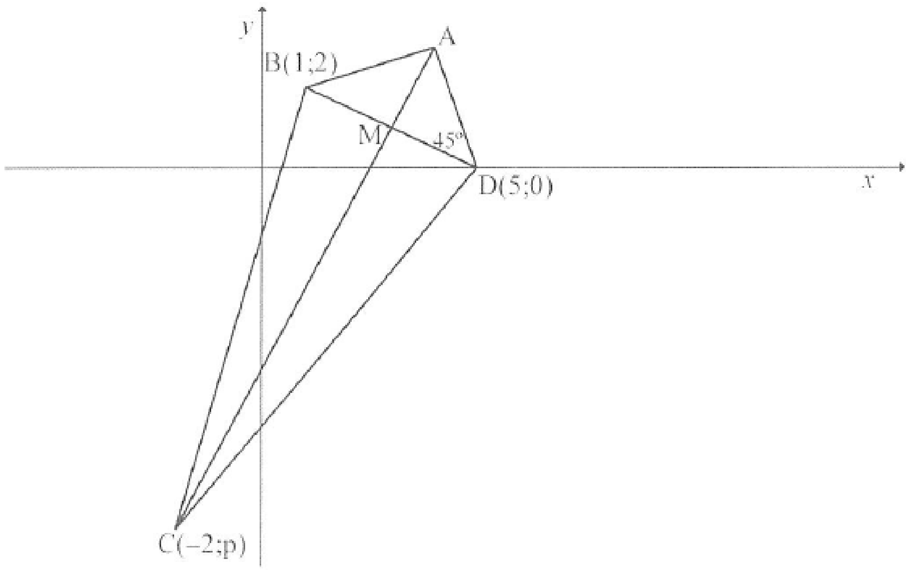
1.4 If it is given that $w = 15\frac{1}{2}$, calculate the length of AD. (3)

1.5 Calculate the area of quadrilateral ABCD. (6)

[20]

QUESTION 2

A, B(1 ; 2), C(–2 ; p) and D(5 ; 0) are the vertices of a KITE.
M is the point of intersection of the diagonals of the kite.
$A\hat{D}B = 45°$.



2.1	Determine the coordinates of M.	(4)
2.2	Calculate the value of p.	(6)
2.3	If $p = -9$, determine the equation of AC.	(5)
2.4	Determine the angle of inclination of AD.	(5)
2.5	Determine the coordinates of A.	(6)
		[26]

QUESTION 3

3.1 If $\tan\theta = \frac{3}{4}$ and $\theta \in [90°;360°]$, determine the value of $2\sin\theta.\cos\theta$ without the use of a calculator. (4)

3.2 Simplify without the use of a calculator:

3.2.1 $$\frac{\sin(360° - x) + \cos(90° + x)}{\sin(180° - x) + \tan 540°}$$ (5)

3.2.2 $\cos 330°.\tan(-120°) + \sin 73°.\left(\frac{1}{\cos 197°}\right)$ (6)

[15]

QUESTION 4

4.1 The identity $\frac{(\sin x - \cos x)^2 - 1}{\sin^2 x - 1} = 2\tan x$ is given.

4.1.1 Prove the identity. (5)

4.1.2 For which values of x in the interval $0° \leq x \leq 360°$ will the identity in 4.1.1 not be defined? (3)

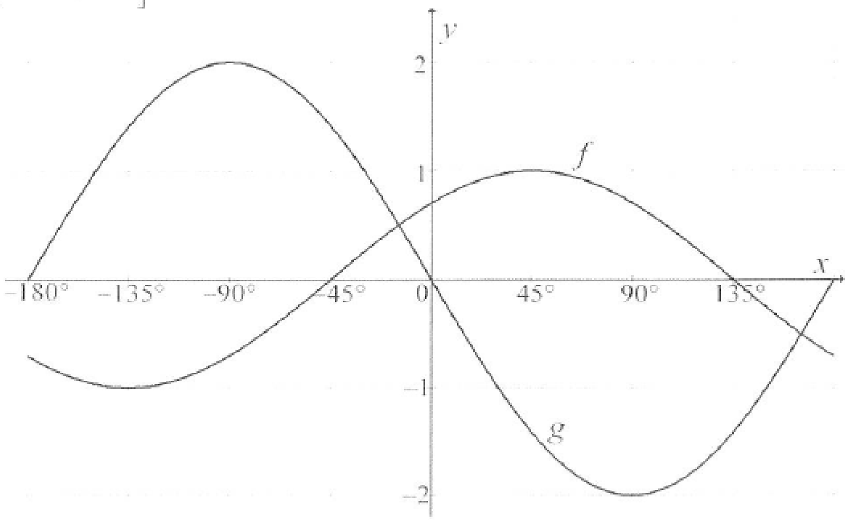
4.2 Solve for x if $\tan(3x + 40°) = -1$ and $x \in [-90°;90°]$. (5)

4.3 Determine the general solution of $2\sin x = \sqrt{3 + 3\cos x}$. (8)

[21]

QUESTION 5

5.1 The sketch represents the graphs of $f(x) = a\cos(x+b)$ and $g(x) = c\sin x$ for $x \in [-180°; 180°]$.



5.1.1 Write down the values of a, b and c. (3)

5.1.2 If the points of intersection of f and g are $(-14,64°; k)$ and $(m; -0,51)$, write down the values of k and m. (4)

5.1.3 For which values of x in the interval $[-180°; 0°]$ will

(a) $f(x) - g(x) < 0$? (2)

(b) $f(x).g(x) \geq 0$? (2)

5.1.4 Determine the minimum value of $h(x)$ if $h(x) = f(x) + 2$. (2)

5.2

5.2.1 Draw a sketch graph of $m(x) = \tan 2x$ for $x \in [0°; 90°]$. (3)

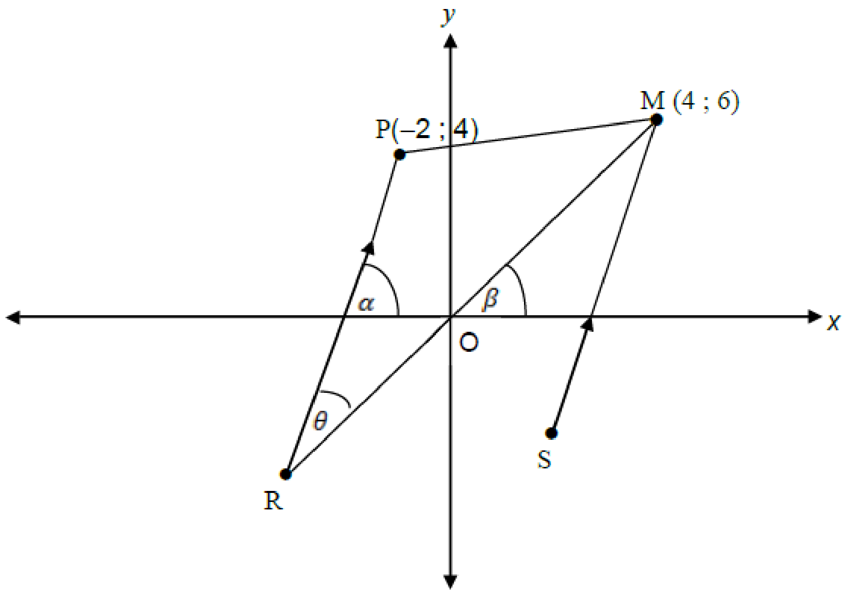
5.2.2 Describe how the graph m has to be transformed to form the graph n where $n(x) = \tan(2x + 50°)$. (2)

[18]

KWV 03

QUESTION 1 **[25]**

In the diagram below, points P (–2; 4), R and M are the vertices of ΔPMR. Line MR passes through the origin. The angle between lines PR and MR is θ and PR||MS.
The equation of line MS is given as $y - 5x + 14 = 0$.



1.1	Determine the equation of line MR.	(3)
1.2	Calculate the equation of line PR.	(4)
1.3	Calculate the size of θ, rounded-off to TWO decimal places.	(5)
1.4	Show that the coordinates of point R can be given as (–4; –6).	(4)
1.5	Calculate the length of line MR, in simplified surd form.	(2)
1.6	If the area of ΔPMR = ½ PR.MR.sinθ, calculate the area of ΔPMR.	(5)
1.7	Write down the coordinates of point S, given that PMSR is a parallelogram.	(2)

QUESTION 2 [26]

2.1 If $\cos\theta = -\frac{7}{25}$, and $\theta \in (180°\ ;\ 360°)$ calculate the value of

$14 \tan\theta$,

with the aid of a diagram and WITHOUT the use of a calculator. (4)

2.2 Simplify WITHOUT the use of a calculator:

$$\frac{\cos(90° + x).\sin(180° + x)}{\tan 225° - \cos^2(-x)}.$$ (6)

2.3 Determine the general solution of

$2\cos 2\theta = -0{,}44.$ (6)

2.4 Prove that

$$\frac{\tan\theta - \sin\theta}{1 - \cos\theta} = \tan\theta.$$ (5)

2.5 If $\alpha + \beta = 90°$, determine WITHOUT the use of a calculator

$$\frac{\cos 700°}{\sin 70°} - \frac{\sin\alpha}{\sin(90° - \beta)}.$$ (5)

QUESTION 3 [14]

Given $f(x) = 2\cos x + 1$ and $g(x) = 1 - \sin x$

3.1 Use the ANSWER SHEET provided on Page 9, and sketch the graphs of f and g for the interval $x \in [-90°; 360°]$. (6)

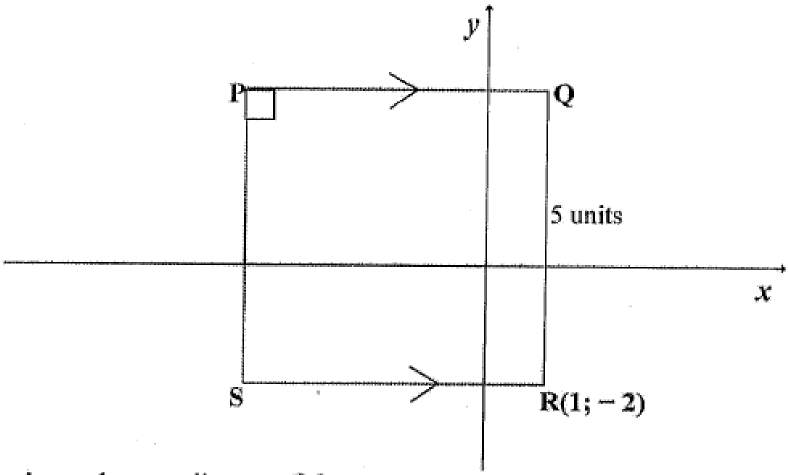
3.2 Write down the amplitude of f. (2)

3.3 Determine the values of x for which $f(x) - g(x) = 0$. (6)

KWV 04

QUESTION 1

1.1 In the diagram below PQRS is a square with sides of 5 units. The coordinates of R is $(1;-2)$. PQ is parallel to the x-axis.



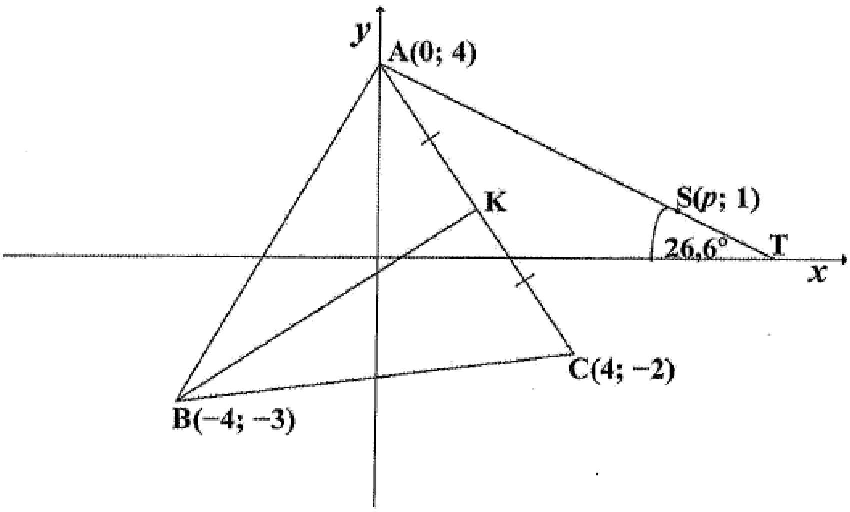
1.1.1 Write down the coordinates of Q. (1)

1.1.2 Write down the coordinates of S. (1)

1.1.3 Write down the equation of PQ. (1)

1.1.4 Write down the equation of QR. (1)

1.2 In the sketch below $A(0;4)$, $B(-4;-3)$ and $C(4;-2)$ are the vertices of $\triangle ABC$. K is the midpoint of AC. AT is drawn with T a point on the x-axis, such that the acute angle between AT and the x-axis is equal to $26{,}6^\circ$. $S(p;\,1)$ is a point on AT.



1.2.1 Determine the coordinates of point K. (2)

1.2.2 Calculate the length of AC, correct to 2 decimal places. (2)

1.2.3 Calculate the gradients of BK and AC and then show that $B\hat{K}C = 90^\circ$. (5)

1.2.4 Determine the equation of line BK. (3)

1.2.5 Calculate the area of $\triangle ABC$, correct to 2 decimal places. (5)

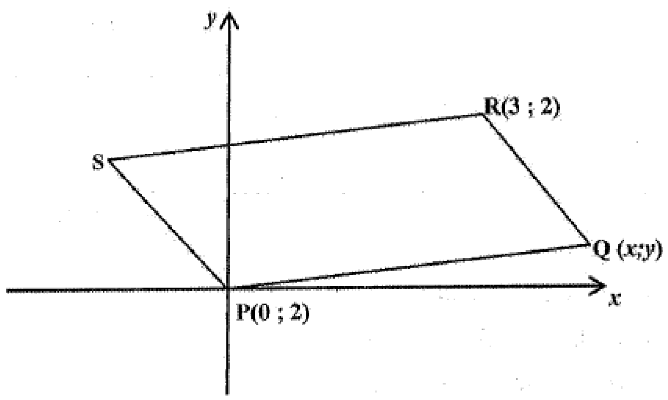
1.2.6 Calculate the value of p. (5)

[26]

QUESTION 2

2.1 PQRS is a parallelogram. The equation of PQ is $y=\frac{1}{4}x$.

The gradient of SP is equal to -1. R is the point (3; 2).



2.1.1 Write down the gradient of RQ. (1)

2.1.2 Determine the equation of RQ. (2)

2.1.3 Calculate the coordinates of point Q. (4)

2.1.4 Calculate the size of $\mathbf{S\hat{P}Q}$. (5)

2.2 Given A (6; 7), B (0; $-$1) and C (4; p).

Calculate

2.2.1 The length of **AB**. (2)

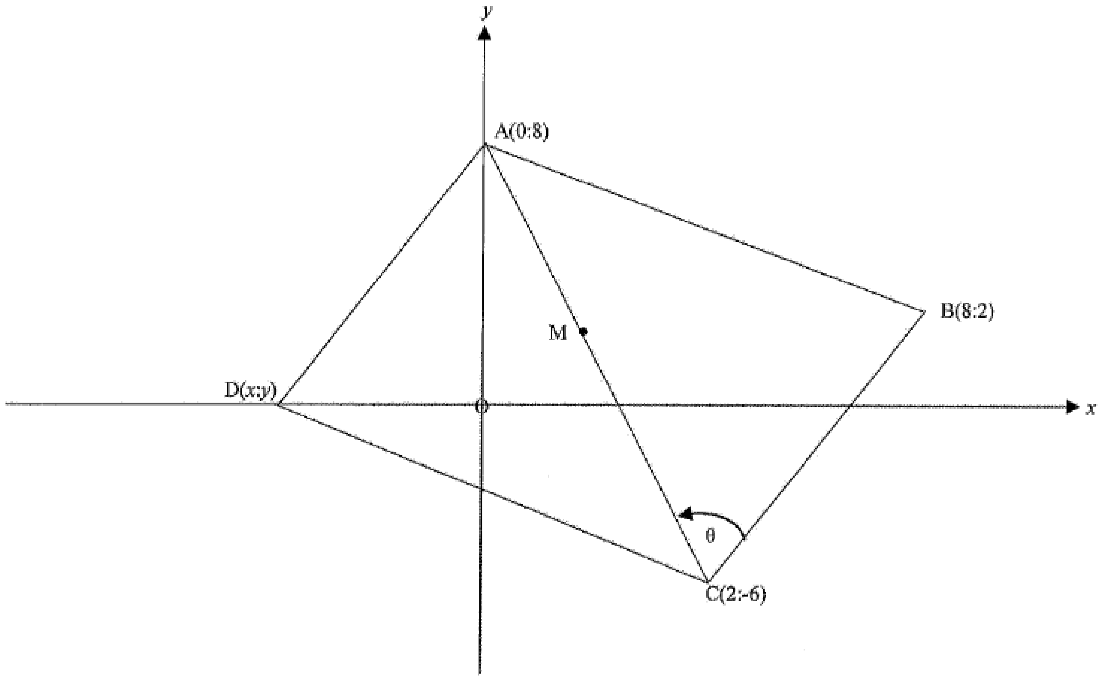
2.2.2 The value of $\boldsymbol{p}$ if **AB = 2 BC**, $p < 0$ (5)

[19]

KWV 05

QUESTION ONE

1.1 In the diagram below A(0;8), B(8;2), C(2;-6) and D $(x\,;y)$ are the vertices of a parallelogram. M is the midpoint of AC. $A\hat{C}B = \theta$.



1.1.1 Calculate the lengths of AB and BC. (4)

1.1.2 Determine the coordinates of M. (3)

1.1.3 Prove that BM is perpendicular to AC. (4)

1.1.4 Prove that $A\hat{B}C = 90^{0}$ (4)

1.1.5 What type of triangle is ΔABC? (2)

1.1.6 Determine the area of Δ ABC. (2)

1.1.7 Determine the equation of BM in the form $y = mx + x$. (3)

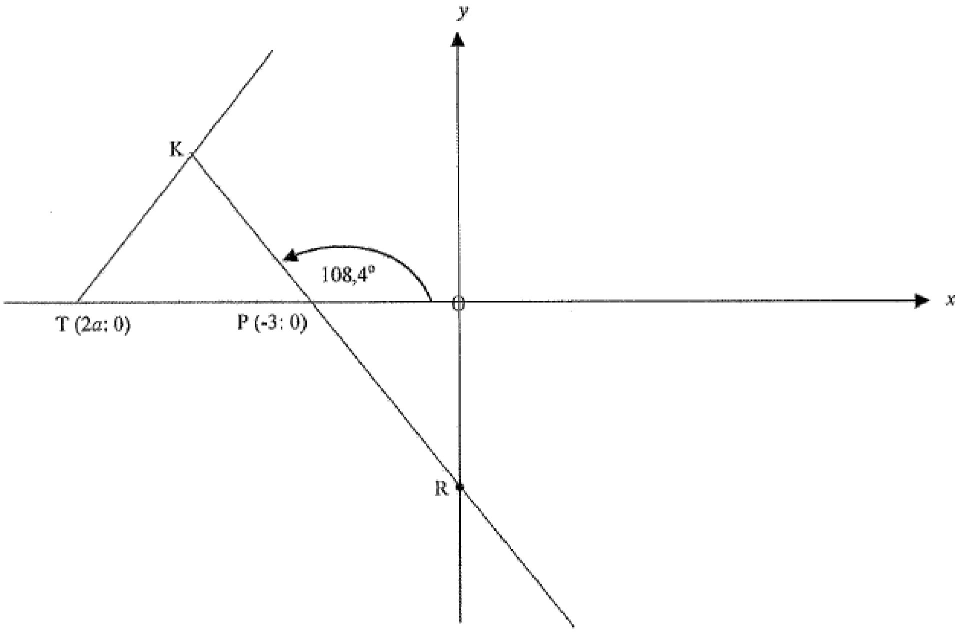
1.1.8 Calculate the size of angle θ. (4)

1.1.9 Determine the coordinates of D. (2)

1.2 Prove that the point (-4;11) lies on the line $3x + 4y = 32$ (3)

1.3 Given the points P(6;5); Q(3;2); R $(2m\,;\,m+4)$ and T $\left(\frac{5}{2}\,;\,\frac{1}{2}\right)$. Calculate the value of m if PQ is parallel to RT. (4)

1.4 In the diagram below P is a point (-3;0) and T is $(2a\ ;\ 0)$. The inclination of the line PR is 108,4° and R is the y-intercept of PR.



Calculate:

1.4.1 the gradient of PR, to the nearest integer value. (2)

1.4.2 the equation of PR in the form $y = mx + c$. (2)

1.4.3 the coordinates of R. (2)

1.4.4 If $T(2a\ ;\ 0)$; $Q\ (a;b)$ and R lie on the same straight line.

Prove that $b = \frac{-9}{2}$ (4)

[45]

QUESTION 3

3.1 If $\tan\theta = \frac{3}{4}$, and $180^\circ < \theta < 270^\circ$, determine with an aid of a sketch the value of:

3.1.1 $\sin\theta$ (3)

3.1.2 $\cos(180^\circ + \theta)$ (2)

3.1.3 θ (answer to 2 decimal places). (2)

3.2 Simplify, without the use of a calculator:

$$\sqrt{\frac{1-\tan^2\theta.\cos(-\theta).\cos(360^\circ-\theta).\tan 225^\circ}{[\sin 90^\circ - \sin(180^\circ + \theta)][\sin 90^\circ - \cos(90 - \theta)]}}$$ (6)

3.3 Consider the functions below:

$f(x) = \sin 2x$ *and* $g(x) = \cos(x + 60^\circ)$

3.3.1 Draw a neat sketch of the curves of f and g for $-180^\circ \leq \theta \leq 180^\circ$ on the axes provided on the diagram sheet. Clearly indicate the intercepts with the axes. (6)

3.3.2 Write down the range for g (1)

3.3.3 Write down the period of f (1)

3.3.4 For which value(s) of x is the graph of g decreasing. (2)

3.4 Determine the general solution of the equation:

$$2\sin^2 x - 5\sin x = 3$$ (5)

3.5 Prove the following identity:

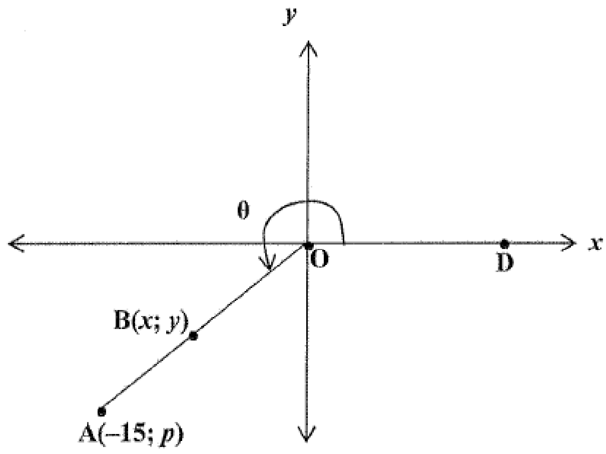
$$\frac{1+\cos A}{\sin A} + \frac{\sin A}{1+\cos A} = \frac{2}{\sin A}$$ (5)

[33]

KWV 06

QUESTION 3

3.1 In the diagram $A(-15; p)$ is a point such that $OA = 17$ and $D\hat{O}A = \theta$, where θ is a reflex angle.



3.1.1 Calculate the value of p. (2)

3.1.2 Determine the value of each of the following without the use of a calculator:

(a) $\cos \theta$ (1)

(b) $\tan (180^\circ - \theta)$ (2)

(c) $\sin (\theta - 360^\circ) \cdot \cos (90^\circ - \theta)$ (3)

3.1.3 **B** is a point on **OA**, such that $OB = 10$. Calculate the values of x and y without calculating the size of angle θ. (4)

3.2 Simplify the following and express your answer as a single trigonometric term.

$$\frac{\cos(-x) \cdot \tan 225^\circ}{\sin 90^\circ - \sin x} + \tan(360^\circ - x)$$ (7)

3.3 Prove the following identity:

$$\frac{2\sin^2 x}{2\tan x - 2\sin x \cos x} = \frac{\cos x}{\sin x}$$ (4)

3.4 Determine the general solution for x if:

$\sin(2x + 15^\circ) = \cos(\frac{1}{2}x - 15^\circ)$ (5)

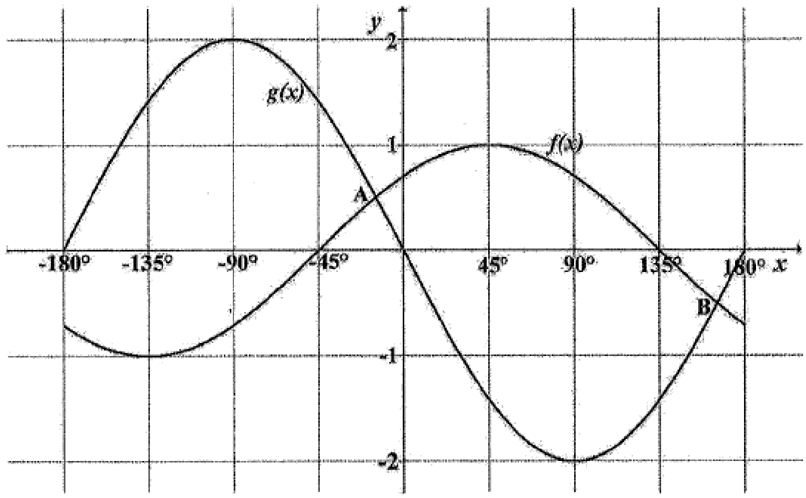
[28]

QUESTION 4

The following sketch represents the graphs of:

$f(x) = a\cos(x+b)$ and

$g(x) = c\sin x$ for $x \in [-180°; 180°]$



4.1 From the sketch above write down the values of a, b and c. (3)

4.2 A $(-14,64°\,;\,p)$ and B $(q\,;\,-0,51)$ are the coordinates of the points of intersection of f and g. Write down, rounded off to 2 decimal places, the values of:

4.2.1 p (1)

4.2.2 q (1)

4.3 For which values of x will $f(x) \, . \, g(x) \geq 0$? (2)

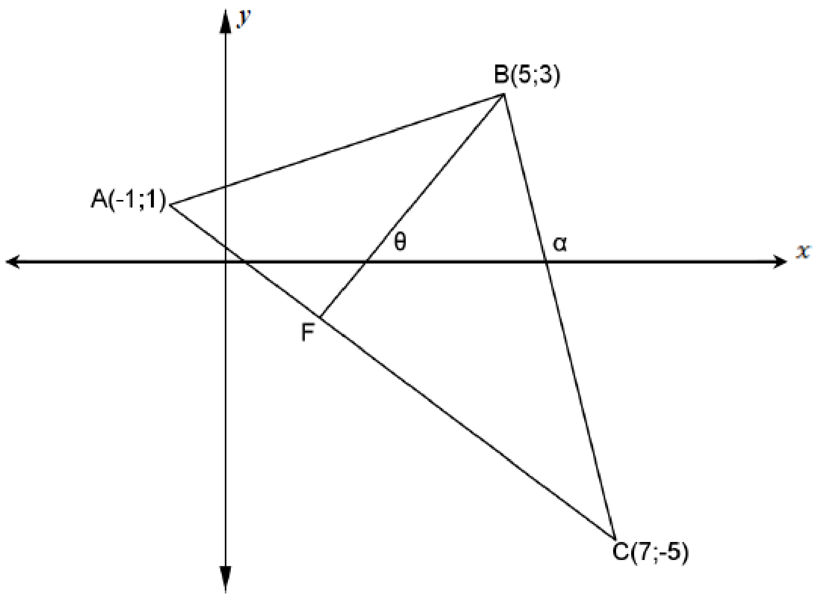
4.4 If the graph of f is shifted $45°$ to the left, write down the equation of the new graph. (1)

[8]

KWV 07

QUESTION 1 **[25]**

In the sketch below the coordinates of the vertices of ΔABC are A(-1 ; 1), B(5 ; 3) and C(7 ; -5).
Point F is a point on AC such that AF = CF.
Line BF and line BC make angles θ and α respectively with the x-axis as indicated on the sketch.



1.1 Calculate the gradient of line BC. (2)

1.2 Calculate the coordinates of point F. (2)

1.3 Determine the equation of the median BF. (3)

1.4 Calculate the size of $F\hat{B}C$. (Rounded off to ONE decimal figure) (5)

1.5 If the coordinates of point K is (6 ; p), calculate the value of p if $A\hat{F}K = 90°$. (4)

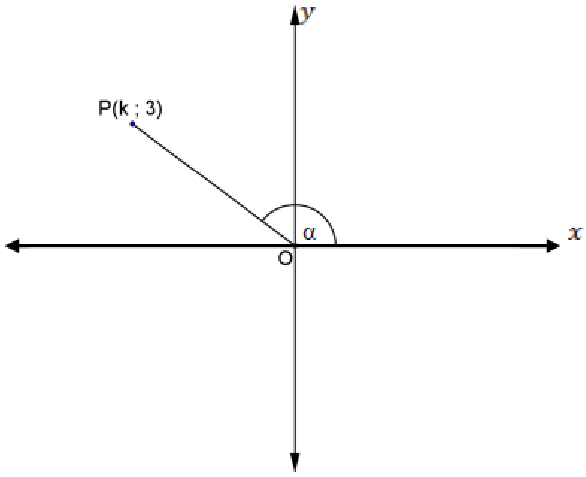
1.6 Calculate the coordinates of point T, given that ABCT is a parallelogram. (2)

1.7 Prove that the diagonals of quadrilateral ABCT bisect each other. (2)

1.8 Determine the perimeter of parallelogram LMNO which is an enlargement by a scale factor of TWO of parallelogram ABCT. (5)

QUESTION 2 **[26]**

2.1 In the figure below, the coordinates of point P(k; 3) are given with $P\hat{O}X = \alpha$ and the length of $OP = 5$ units.



Determine the value of …

2.1.1 k (2)

2.1.2 $\tan \alpha$ (1)

2.1.3 $\cos (90° + \alpha)$ (2)

2.1.4 α (2)

2.2 Given that $\hat{A}$ and $\hat{B}$ are complementary angles and $7 \cos A - 3 = 0$. Determine WITHOUT the use of a calculator, the value of:

$$7 \cos B - 3 \tan A.$$ (4)

2.3 Simplify WITHOUT the use of a calculator:

$$\frac{\sin 210°.\cos 790°.\tan(-330°)}{\sin 160°}$$ (5)

2.4 Prove that:

$$\frac{\sin x - \sin x \cos x}{\cos x - 1 + \sin^2 x} = \tan x$$ (4)

2.5 Given that $\theta \in [-360°; 90°]$ determine the value of θ if:

$$\sin 2\theta = \cos(\theta + 30°)$$ (6)

QUESTION 3 **[14]**

3.1 The functions $f(x) = \cos 2x$ and $g(x) = \sin(x + 45°)$ are given.

Use ANSWER SHEET A and sketch the graphs of f and g on the same set of axes for the interval $x \in [-90°; 180°]$

Clearly indicate all turning points and intercepts that f and g make with the axes. (6)

3.2 Use the graph and write down the:

3.2.1 range of f. (2)

3.2.2 period of g. (1)

3.2.3 the NUMBER of x-values for which $f(x) = g(x)$. (1)

3.3 Determine for which value(s) of x where $x \in [0°; 180°]$ will:

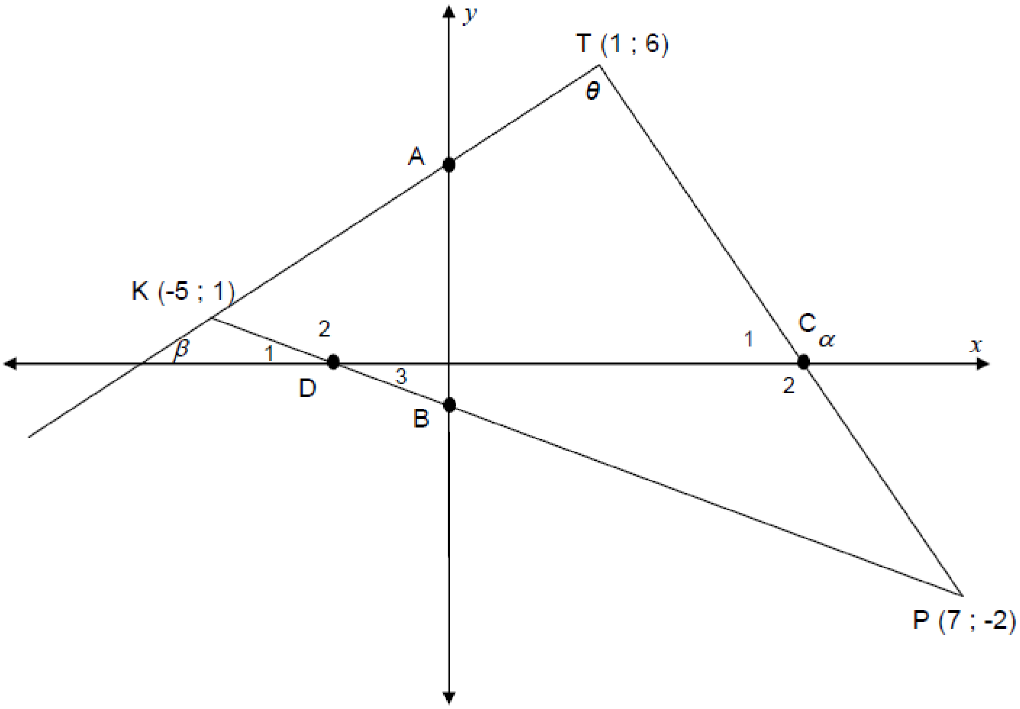
$$\cos 2x \cdot \sin(x + 45°) \leq 0$$ (2)

3.4 Determine the equation of the graph of h which represents the graph of g shifting up ONE unit and $30°$ to the right. (2)

KWV 08

QUESTION 1

In the diagram below, K(-5 ; 1) , P(7 ; -2) and T(1 ; 6) are the vertices of ΔKTP. A and B are points on the *y*-axis and C and D are points on the *x*-axis.



1.1 Calculate the length of KT. (Leave the answer in simplest surd form.) (3)

1.2 Determine the equation of line KP in the form $y = mx + c$. (3)

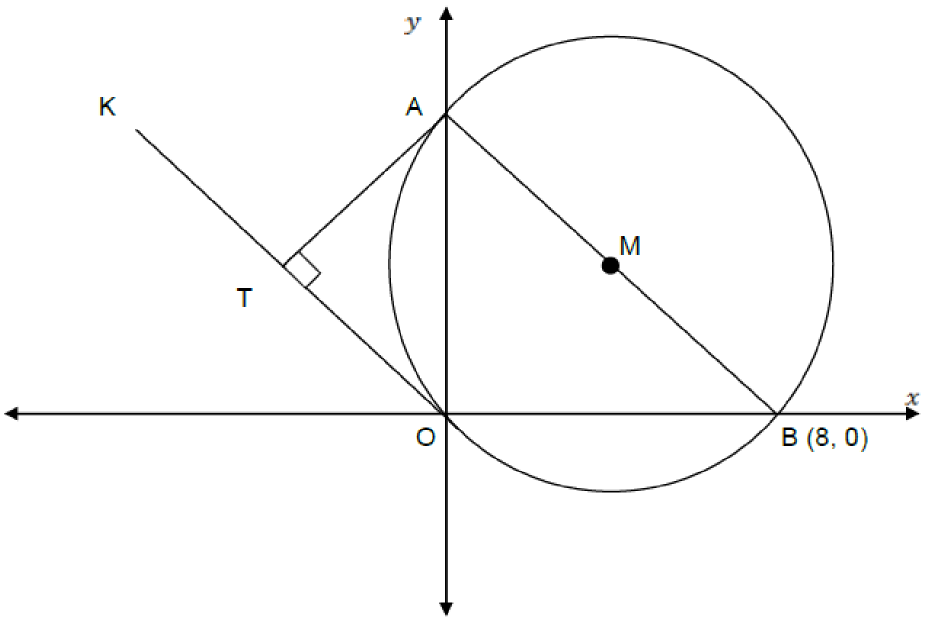
1.3 Calculate the length of AB. (4)

1.4 Calculate the size of $K\hat{T}P$. (6)

[16]

QUESTION 2

In the diagram below, the circle with centre M passes through the origin. AB is the diameter of the circle with B(8 ; 0).



2.1	Calculate the x-co-ordinate of Point M.	(4)
2.2	Calculate the co-ordinates of Point A, the other y-intercept of the circle with centre M(4 ; 2).	(3)
2.3	Determine the equation of the line OK which is parallel to AB.	(3)
2.4	Determine the x-co-ordinate of T which lies on line OK, such that AT is the shortest distance from A to line OK.	(4)
		[14]

QUESTION 3

3.1 If $13\sin\alpha = -5$ and $\tan\alpha > 0$, use a diagram to evaluate: $3\cos\alpha$. (5)

3.2 Simplify the following expressions **without** the use of a calculator.

3.2.1 $\dfrac{\sin(\theta - 180°).\tan(360° - \theta).\sin(90° - \theta)}{\cos^2(\theta + 180°)}$ (6)

3.2.2 $\dfrac{\sin 210°.\cos 400°}{\sin(-50°).\cos 120°}$ (6)

3.3 If $(4\theta - 8)\sin 30° = (\theta^3 - 8)$ and $(\theta^2 + 2\theta + 4) = 2$, determine the value of $\tan 240°$ **without** the use of a calculator. (5)

3.4 3.4.1 Prove that : $\dfrac{1}{\tan\alpha}(\sin\alpha\tan\alpha + \cos\alpha) = \dfrac{1}{\sin\alpha}$ (4)

3.4.2 Determine for which value(s) of α is:

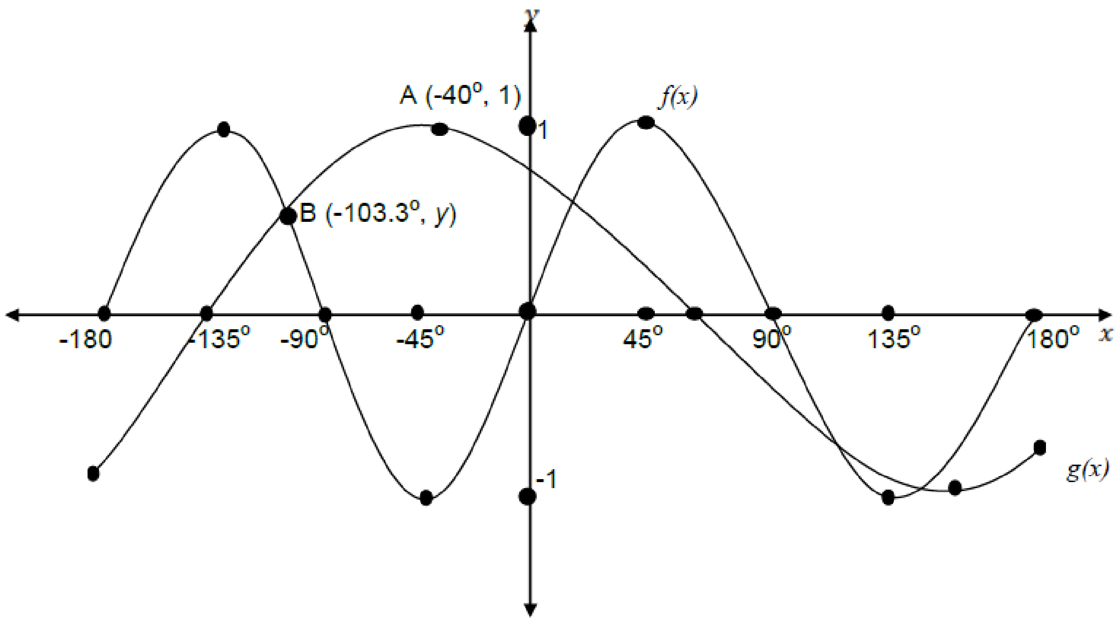
$\dfrac{1}{\tan\alpha}(\sin\alpha\tan\alpha + \cos\alpha)$ undefined for $\alpha \in [0°; 360°]$. (2)

[28]

QUESTION 4

The sketch below shows the graphs of:

$$f(x) = \sin ax \text{ and } g(x) = \cos(x + \theta), \text{ for } x \in [-180°; 180°]$$



4.1 Determine the period of $f(x) = \sin ax$ (1)

4.2 Write down the range of $g(x) = \cos(x + \theta)$. (2)

4.3 Write down the values of θ and a. (2)

4.4 Calculate the value of: $g(180°)$. (1)

4.5 Determine the values of x, if $x \in [0°; -180°]$ for which:

4.5.1 $f(x) - g(x) > 0$ (2)

4.5.2 $g(x).f(x) \geq 0$ (2)

4.6 Determine the minimum value of: $3^{\cos(90° - 2x)}$ (2)

[12]