

MATHEMATICS

FINAL PUSH CAMP

LEVEL 1-3

2026

ALGEBRA

Mpumalanga Preparatory 2026

QUESTION 1

1.1 Solve for x if:

$$1.1.1 \quad 2x(x-1) + 5(x-1) = 0 \quad (2)$$

$$1.1.2 \quad -4x - 3x^2 = -5 \quad \text{Correct to 2 decimal places.} \quad (4)$$

$$1.1.3 \quad 9^x - 3^x = 6 \quad (4)$$

$$1.1.4 \quad \sqrt[3]{32} = 8^{3x} \cdot 2^{6x} \quad (3)$$

$$1.1.5 \quad -(x+2)(x-3) \leq 0 \quad (3)$$

1.2 Solve for x and y simultaneously:

$$y - 2 = (x - 2)^2 \quad (5)$$

$$y - x = 2$$

1.3 Prove that the roots of $3x^2 + 2kx - k = 2x$ are never equal, for any real number k . (4)

1.4 Determine the value of: $\frac{5^{2006} - 5^{2004} + 24}{5^{2004} + 1}$ (3)

[28]

Western Cape PLC Inter Districts

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad x^2 + 3x = 10 \quad (3)$$

$$1.1.2 \quad 2x^2 = 7x + 3 \quad (\text{correct to TWO decimal places}) \quad (4)$$

$$1.1.3 \quad 3x^2 + 13x + 10 \geq 0 \quad (3)$$

$$1.1.4 \quad 2\sqrt{x+9} + 6 = x \quad (4)$$

1.2 Solve for x and y simultaneously if

$$\log_2(x + y) = 3 \text{ and } x^2 + 5xy + 6y^2 = 0 \quad (6)$$

1.3 If a and b are nonzero real numbers such that $a^2 = b(b + 1)$ and $b^2 = a + 1$

$$\text{determine the value of } \frac{1}{a} + \frac{1}{b}. \quad (4)$$

[24]

Free State Pre-Trial 2026

QUESTION 1

1.1 Solve for x :

$$1.1.1 \quad (2x + 1)(3 - x) = 6 \quad (3)$$

$$1.1.2 \quad (x - 5)^2 \leq 1 \quad (3)$$

$$1.1.3 \quad (2^{x+1})^4 \cdot 12^{1-2x} = 1\,728 \quad (4)$$

$$1.1.4 \quad 5 - \sqrt{4x + 1} = x \quad (5)$$

1.2 Solve for x and y if:

$$y = 2 - x \text{ and } \frac{x^2 - 4x + 2}{(x - 3)(x - 2)} = -\frac{2}{y} \quad (6)$$

1.3 Given $x^2 + 4x + m = 0$

$$1.3.1 \quad \text{Show that the roots of the equation are } x = -2 \pm \sqrt{4 - m}. \quad (3)$$

$$1.3.2 \quad \text{For which values of } m \text{ will the equation have real roots?} \quad (1)$$

[25]

Eastern Cape Trial 2026

QUESTION 1

1.1 Solve for x :

1.1.1 $2x(x-3) = 0$ (2)

1.1.2 $5x = -2x^2 - 1$ (correct to TWO decimal places) (4)

1.1.3 $-x^2 + 2x + 3 > 0$ (4)

1.1.4 $25^x - 26.5^x = -25$ (4)

1.2 Solve simultaneously for x and y , if:

$2x - y = 1$ and $x^2 - y^2 = xy - 11$ (6)

1.3 Given that $m(x) = \frac{3x-2}{4x}$ and $n(x) = \frac{x+2}{\sqrt{x+5}}$

Determine the value(s) of x if $m(n(x)) = \frac{1}{7}$ (5)

November 2025 final

QUESTION 1.

1.1 Solve for x :

1.1.1 $(x+5)(x-2) = 0$ (2)

1.1.2 $5x^2 + 2 = -9x$ (correct to TWO decimal places) (4)

1.1.3 $8x^2 > 2x$ (4)

1.1.4 $2.2^{2x} - 9.2^x + 4 = 0$ (4)

1.1.5 $\sqrt{\frac{1}{x} + 2} = \frac{1}{\sqrt{x}}$ (5)

1.2 Calculate the values of x and y if:

- x is the sum of 2 and y
 - Five times the product of x and y , is 6 more than the square of x
- (6)
[25]

NUMBER PATTERNS

November 2023 Final

QUESTION 2

- 2.1 Given the arithmetic series: $7 + 12 + 17 + \dots$
- 2.1.1 Determine the value of T_{91} (3)
- 2.1.2 Calculate S_{91} (2)
- 2.1.3 Calculate the value of n for which $T_n = 517$ (3)
- 2.2 The following information is given about a quadratic number pattern:
- $T_1 = 3$, $T_2 - T_1 = 9$ and $T_3 - T_2 = 21$
- 2.2.1 Show that $T_5 = 111$ (2)
- 2.2.2 Show that the general term of the quadratic pattern is $T_n = 6n^2 - 9n + 6$ (3)
- 2.2.3 Show that the pattern is increasing for all $n \in N$. (3)
- [16]

QUESTION 3

- 3.1 Given the geometric series: $3 + 6 + 12 + \dots$ to n terms.
- 3.1.1 Write down the general term of this series. (1)
- 3.1.2 Calculate the value of k such that: $\sum_{p=1}^k \frac{3}{2}(2)^p = 98\,301$ (4)
- 3.2 A geometric sequence and an arithmetic sequence have the same first term.
- The common ratio of the geometric sequence is $\frac{1}{3}$
 - The common difference of the arithmetic sequence is 3
 - The sum of 22 terms of the arithmetic sequence is 734 more than the sum to infinity of the geometric sequence.
- Calculate the value of the first term. (5)

November 2025 Final

- 2.1 Given the infinite geometric series: $(t + 10) + (t - 2) + (t + 4) + \dots$
- 2.1.1 Show that $t = -2$ (3)
- 2.1.2 Calculate the value of T_{25} . Write your answer in the form $T_n = b^x$ (3)
- 2.1.3 Calculate the sum of the infinite series. (2)

2.2 Given $\sum_{p=k}^{117} (4p-1) = 26\,675$

2.2.1 Write down the difference between T_6 and T_{14} (2)

2.2.2 Calculate the value of k . (5)
[15]

November 2024 Final

2.1 The first term of an arithmetic series is 7. The common difference of this series is 5 and the series contains 20 terms.

2.1.1 Calculate the sum of this series. (2)

2.1.2 The original arithmetic series is extended to 75 terms. The sum of these 75 terms is 14 400. Using sigma notation, write down an equation for the sum of the terms added to the original series. (4)

2.2 The sequence of the first differences of a quadratic pattern is: 1 ; 3 ; 5 ; ...

2.2.1 If T_{99} of this quadratic pattern is 9 632, calculate the value of T_{98} . (3)

2.2.2 If it is further given that the third term of the quadratic pattern is 32, determine the general term, T_n , of the quadratic pattern. (5)

3.1 Given: $\sum_{p=4}^{21} (-3)^p$

3.1.1 Write down the values of the first three terms of the series. (2)

3.1.2 Write down the value of the constant ratio. (1)

3.1.3 Will $\sum_{p=4}^{21} (-3)^p$ converge? Explain your answer. (2)

3.1.4 Calculate $\sum_{p=4}^{21} (-3)^p x$. Give your answer in terms of x . (3)

3.2 $6 - x$, 5 and $\sqrt{4x+12}$ are the first three terms of an arithmetic sequence. (5)

3.2.1 Determine the value of x . (5)

3.2.2 Calculate the value of the 10th term of this arithmetic sequence. (3)

FUNCTIONS

PART 1

Free State Trial 2026

Given: $f(x) = \frac{3}{x-1} - 1$ and $g(x) = \left(\frac{1}{3}\right)^x - 1$

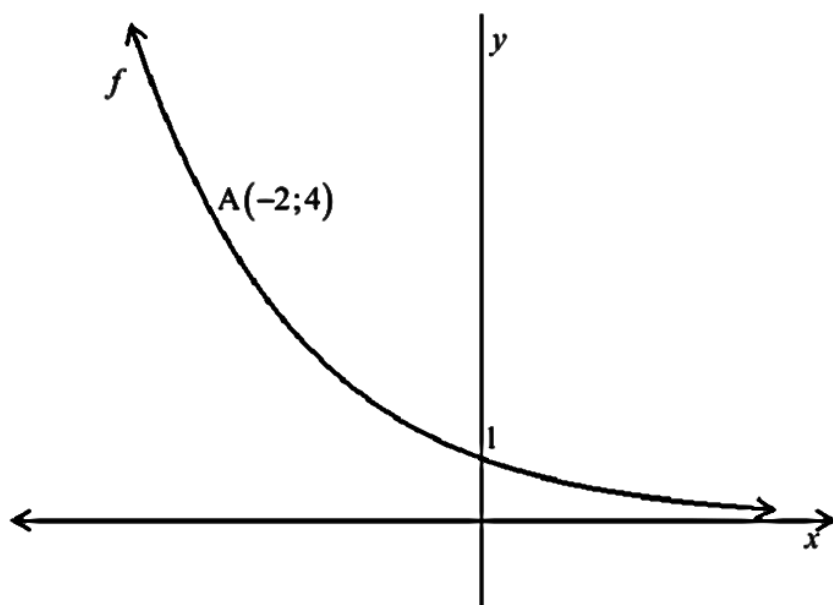
- 4.1 On the set of axes provided on the DIAGRAM SHEET, draw sketch graphs of f and g . Show intercepts with the axes and any asymptotes. (8)
- 4.2 Write down the domain of f . (1)
- 4.3 Write down the range of g . (1)
- 4.4 Write down the axes of symmetry of f . (2)
- 4.5 Determine the values of x for which $f(x) < g(x)$. (1)

[13]

Free State June 2025

QUESTION 6

Sketched below is the graph of $f(x) = k^x$. $A(-2;4)$ is the point on the graph of f .

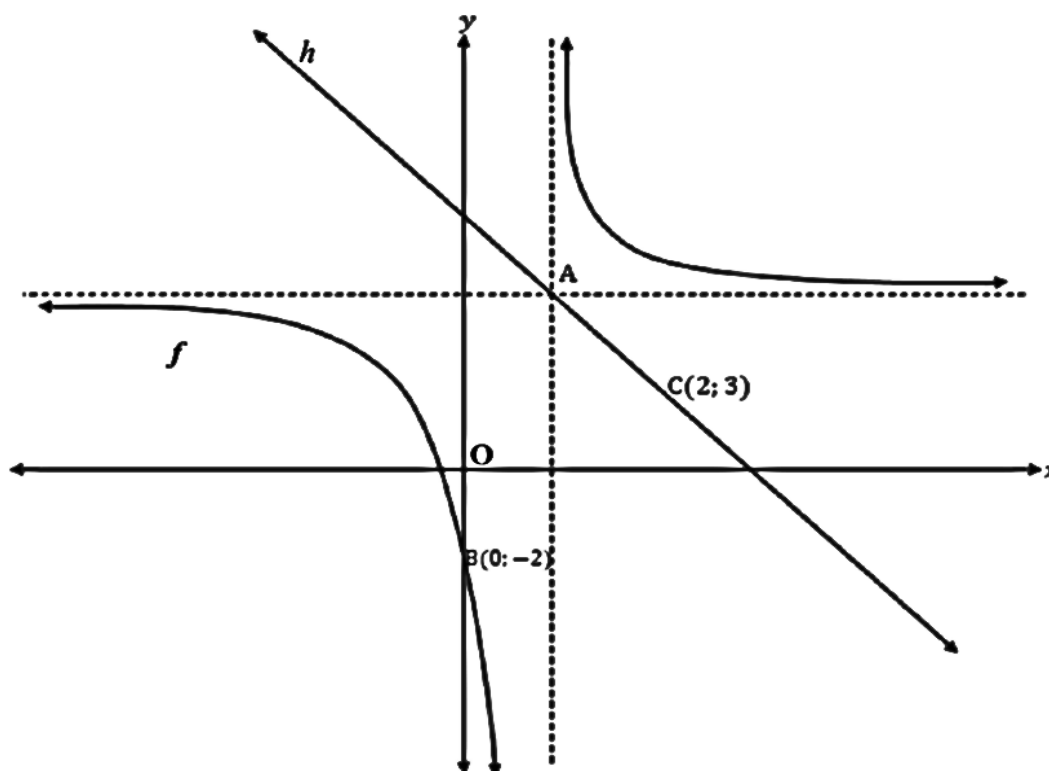


- 6.1 Write down the equation of the asymptote of f . (1)
- 6.2 Determine the value of k . (2)
- 6.3 Determine the value of x for which: $f(-x) - f(x) = \frac{15}{4}$. (4)
- 6.4 Determine the equation of h , the reflection of f about the line $y = x$. (2)
- 6.5 For which values of x will $h(x) \geq -1$. (2)

[11]

Free State June 2024

In the sketch below the graph of $f(x) = \frac{a}{x+p} + 4$ is given. The asymptotes of f intersect at point A. The graph of f cuts the y-intercept at $B(0; -2)$. The axis of symmetry of f , is the line h . Point C coordinates $C(2; 3)$ is the point on h .



- 6.1.1 Determine the equation of h . (2)
- 6.1.2 Determine the coordinates of point A. (2)
- 6.1.3 Determine the equation of f . (3)
- 6.1.4 Determine the equation of the asymptotes of $f(x+1)$ (2)
- 6.1.5 Write down the coordinates of the image of $D\left(-\frac{1}{2}; 0\right)$ if D is reflected about the axis of symmetry $y = x + 3$ (2)
- 6.2 Draw a rough sketch of the graph $y = a - \frac{1}{b-x}$, ($a > 0, b < 0$) (3)

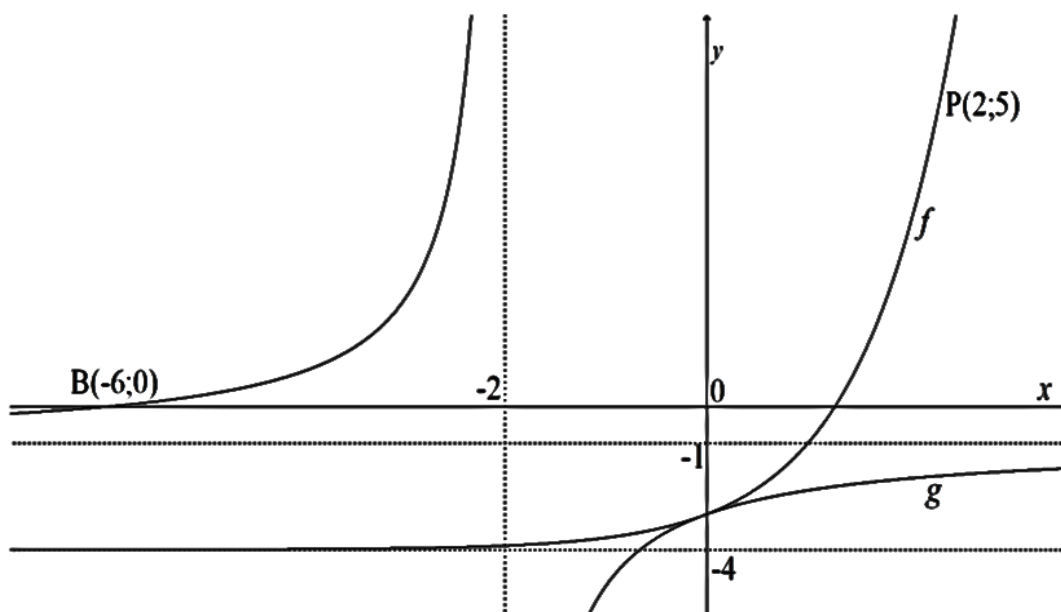
[14]

Free State Trial 2025

The diagram below shows the graphs of the functions of $f(x) = b^x + c$ and

$$g(x) = \frac{a}{x+p} + q.$$

- $B(-6; 0)$ is the x -intercept of g .
- The graphs of f and g have a common y -intercept.
- $P(2; 5)$ is a point on f .



- 4.1 Write down the values of p and q . (2)
- 4.2 Determine the equation of g . (3)
- 4.3 Determine the equation of the inverse of the axis of symmetry of g for $m < 0$. (4)
- 4.4 Write down the equation of the asymptote of f . (1)
- 4.5 Determine the equation of f . (3)
- 4.6 Determine the equation of h if $h(x) = f(x) + 4$ (2)
- 4.7 Determine the equation of h^{-1} , the inverse of h , in the form $y = \dots$ (2)
- 4.8 For which values of x is $f(x) \geq g(x)$? (2)
- [19]

PART 2

KwaZulu Natal Trial 2025

Given: $f(x) = x^2 - 5x - 14$ and $g(x) = 2x - 14$

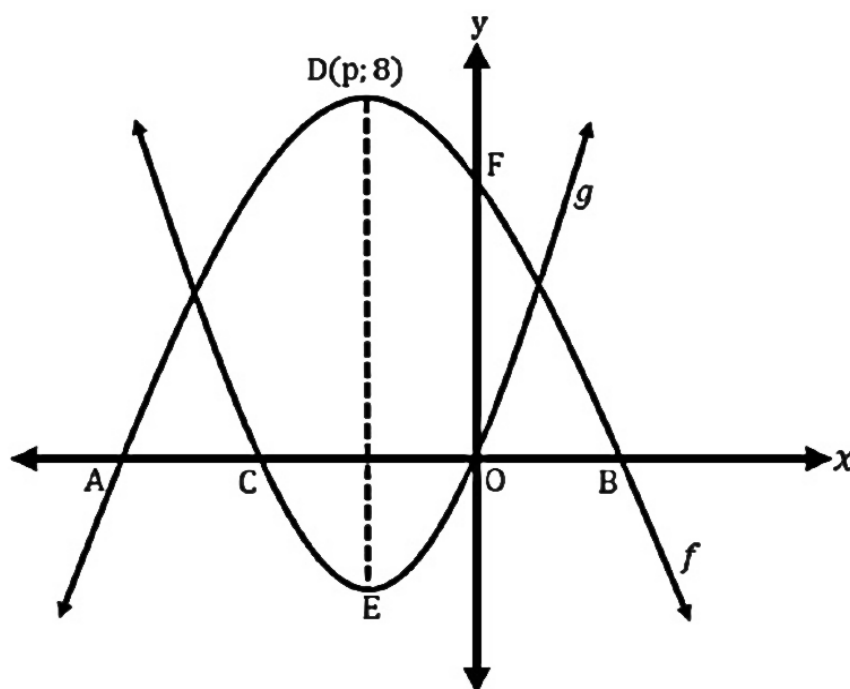
- 5.1 On the same set of axes, sketch the graphs of f and g . Clearly indicate all intercepts with the axes and turning points. (6)
- 5.2 Determine the equation of the tangent to f at $x = 2\frac{1}{2}$. (2)
- 5.3 Determine the value(s) of k for which $f(x) = k$ will have two unequal positive real roots. (2)
- 5.4 A new graph h is obtained by first reflecting g in the x -axis and then translating it 7 units to the left. Write down the equation of h in the form $h(x) = mx + c$. (2)
- [12]

Gauteng June 2025

QUESTION 4

The graphs of $f(x) = ax^2 + bx + \frac{15}{2}$ and $g(x) = x^2 + 2x$ are sketched below.

A and B are the x -intercepts of graph f . $D(p; 8)$ is the turning point of graph f . C is the x -intercept of graph g . Graph g passes through the origin. E is the turning point of graph g .

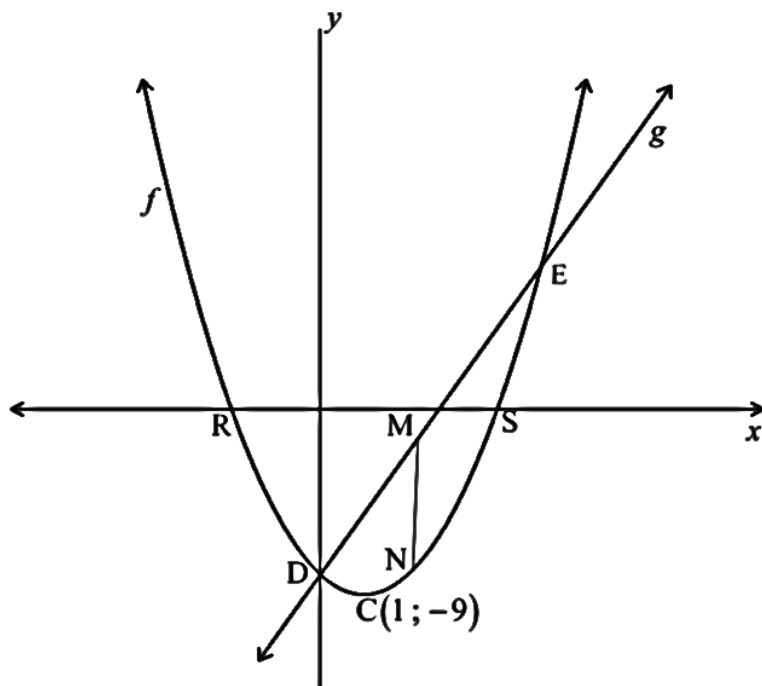


- 4.1 Write down the coordinates of point F. (1)
- 4.2 Determine the coordinates of C. (2)
- 4.3 The turning points of graphs f and g lie on the same vertical line DE.
Determine:
 - 4.3.1 The value of p (1)
 - 4.3.2 The length of DE (2)
- 4.4 Show that $a = -\frac{1}{2}$ and $b = -1$. (4)
- 4.5 Determine the equation of a straight line joining the points of intersection of graphs f and g . (Round-off your answers to 2 decimal places.) (5)

[15]

Free State June 2025

Sketched below are the graphs of $f(x) = a(x+p)^2 + q$ and $g(x) = 3x - 8$. R and S are the x -intercepts of f . D is the y -intercept of both f and g . $C(1; -9)$ is the turning point of f . The two graphs intersect at D and E. MN is parallel to the y -axis with M on g and N on f .

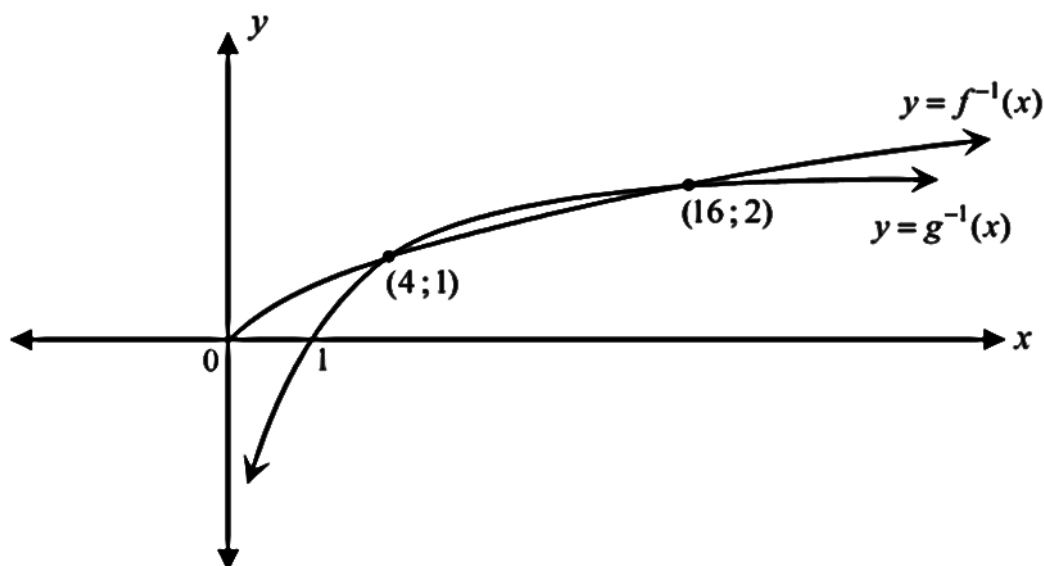


- 5.1 Write down the coordinates of D. (1)
- 5.2 Show that the equation of f is $f(x) = x^2 - 2x - 8$ (3)
- 5.3 Calculate the length of RS. (3)
- 5.4 Determine the range of h if $h(x) = -f(x) - 4$. (2)
- 5.5 Determine the value of x for which $MN = 6$ units. (4)
- 5.6 Given that $E(5; 7)$, hence determine for which values of x will $f(x) < g(x)$ (2)
- 5.7 Determine the value(s) of k for which $y = 3x + k$ will be a tangent to the graph of f . (5)

[20]

Free State Trial 2026

The sketch below represents the inverses of $f(x) = ax^2$; $x \geq 0$ and $g(x) = 4^x$. The graph of f^{-1} and g^{-1} intersect at $(4; 1)$ and $(16; 2)$. The graph of g^{-1} cuts the x -axis at 1.



- 6.1 Write down the coordinates of ONE point through which both the graphs of f and g pass. (1)
 - 6.2 Determine the equation of f . (3)
 - 6.3 How has the domain of f been restricted? (1)
 - 6.4 Determine the equation of g^{-1} in the form $g^{-1}(x) = \dots$ (1)
 - 6.5 If $h(x) = g^{-1}(x-2)$, for which values of x will $h(x) \leq 0$? (2)
- [8]**

CALCULUS

Kwa Zulu Natal June 2026

QUESTION 8

8.1 Given: $f(x) = -7x^2 - 3$

8.1.1 Determine $f'(x)$ from first principles. (5)

8.1.2 Calculate the gradient of the tangent to f at $x = -\frac{1}{2}$. (2)

8.2 Determine:

8.2.1 $\frac{dy}{dx}$ if $y = 3x(x^2 - 2)$ (3)

8.2.2 $D_x \left[\frac{\sqrt[3]{x^2 - 8x}}{x} \right]$ (3)

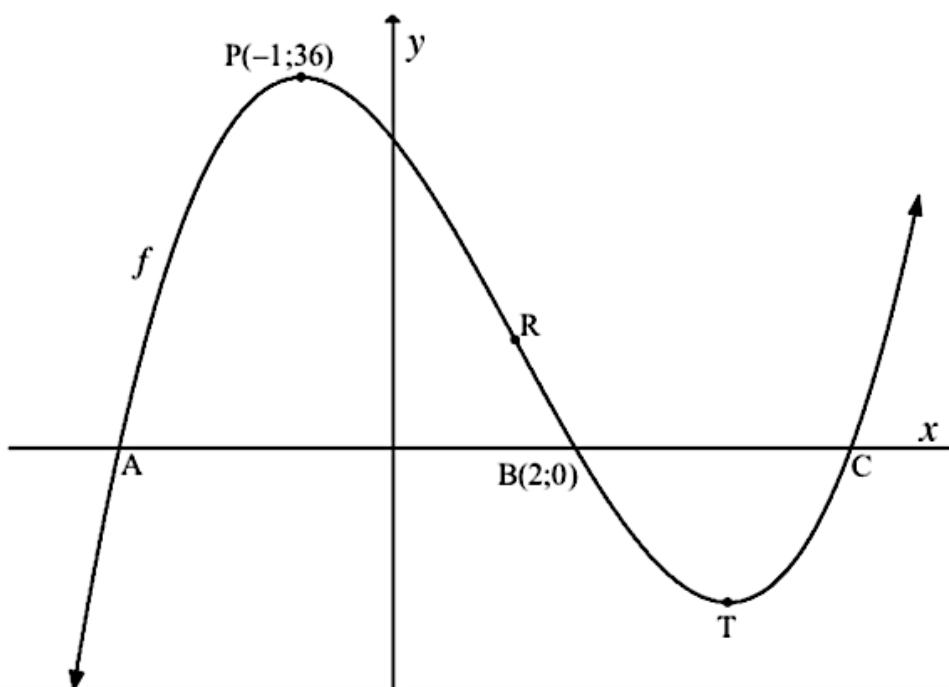
[13]

Kwa Zulu Natal June 2026

QUESTION 9

The diagram below shows the graph of $f(x) = x^3 + px^2 + qx + 30$.

A, B(2;0) and C are the x -intercepts of f , and P(-1;36) and T are the turning points. R is the point of inflection.



- 9.1 Show that $p = -4$ and $q = -11$. (5)
- 9.2 Calculate the coordinates of point T. (4)
- 9.3 Determine the length of AC. (4)
- 9.4 Determine the x-coordinate of point R. (2)
- 9.5 For which values of x is:
- 9.5.1 $f'(x) > 0$ (2)
- 9.5.2 $\frac{f''(x)}{x} < 0$ (2)

Free State Trial 2026

QUESTION 8

- 8.1 Given: $f(x) = x^2 - 3$
- 8.1.1 Determine the average gradient between $x = 1$ and $x = 2$. (3)
- 8.1.2 Determine $f'(x)$ by using first principles. (4)
- 8.2 Determine the following leaving answers with positive exponents.
- 8.2.1 $\frac{dy}{dx}$ if $y = \frac{3\sqrt{x} - 4}{\sqrt{x}}$ (3)
- 8.2.2 $\frac{dy}{dx}$ if $\frac{y}{p} = (x-1)^2$ where p is a constant. (3)

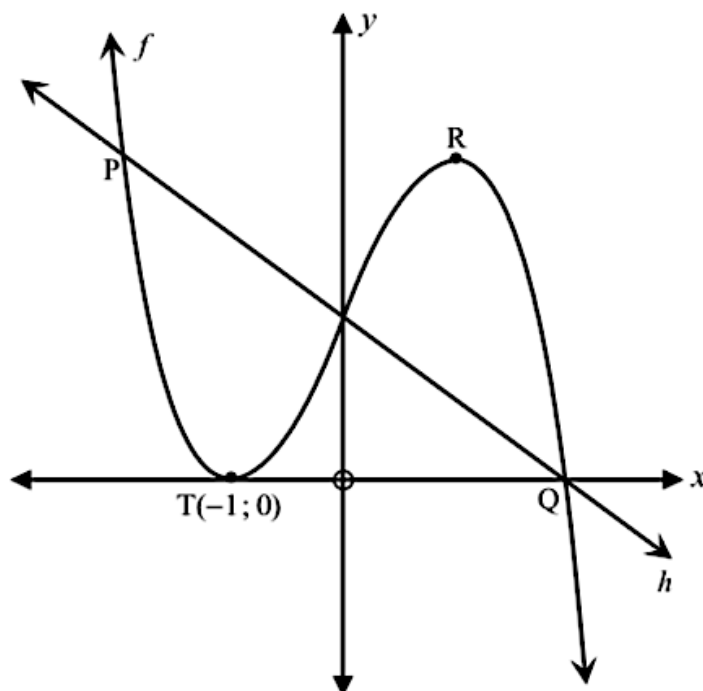
QUESTION 7

- 7.1 If $f(x) = \frac{4}{x}$, determine $f'(x)$ from first principles. (5)
- 7.2 Determine:
- 7.2.1 $\frac{dy}{dx}$ if $y = 5x^2 + 5x + 2$ (2)
- 7.2.2 $D_x \left[\sqrt[3]{x^2} - \frac{1}{2}x \right]$ (3)
- 7.3 Given: $p(x) = x^3 + 2x$
- Show, using relevant calculations, why it is not possible for a tangent drawn to the graph of p to have a negative gradient. (3)
- [13]**

Free State Sept Trial 2026

QUESTION 9

The graphs of $f(x) = -x^3 + 3x + 2$ and $h(x) = 2 - x$ are drawn below.
 The graphs intersect at P and Q. R is a turning point on the graph of f .
 The graph of f has x -intercepts at Q and $T(-1; 0)$.



- 9.1 Determine the coordinates of Q. (2)
- 9.2 Determine the coordinates of R. (3)
- 9.3 Determine the point at which the graph of f changes concavity. (2)
- 9.4 Draw a neat sketch graph of $y = f'(x)$ showing the intercepts on the axes. (2)

QUESTION 9

Given $f(x) = x^3 - 6x^2 + 9x - 4$

- 9.1 Write down the coordinates of the y -intercept of f . (1)
- 9.2 Determine the values of x for which $f'(x) = 0$. (3)
- 9.3 Determine the coordinates of the x -intercepts of f . (4)
- 9.4 Sketch the graph of f , showing ALL intercepts with axes and the coordinates of the turning points. (4)
- 9.5 For which values of x is f concave up? (2)

Limpopo Pre-Trial 2026

QUESTION 8

8.1 Given $f(x) = 3x - x^2$

Determine $f'(x)$ from first principles (5)

8.2.1 $f'(x)$ where $f(x) = \frac{x^4 - x + 5}{x}$, giving your answer with positive exponents. (3)

8.2.2 $\frac{dy}{dx}$ if $y = 4\sqrt{x} - \frac{8}{\sqrt{x}} + \pi x^3$ (4)

8.3 Determine the gradient of the tangent of the graph of $f(x) = -x^3 - 4x + 5$ at $x = -1$ (3)

[15]

Mpumalanga Pre-Trial 2026

QUESTION 8

8.1 Find $f'(x)$ by making use of first principles if $f(x) = -\frac{3}{x}$ (6)

8.2 Differentiate the following by making use of the rules:

8.2.1 $y = \frac{x^2 - 3x + 1}{x^3}$ (4)

8.2.2 $y = \frac{\sqrt{t}}{2} - \frac{4}{7t^5}$ (4)

[14]

QUESTION 8

8.1 Given that: $f(x) = -x^2 + 3$

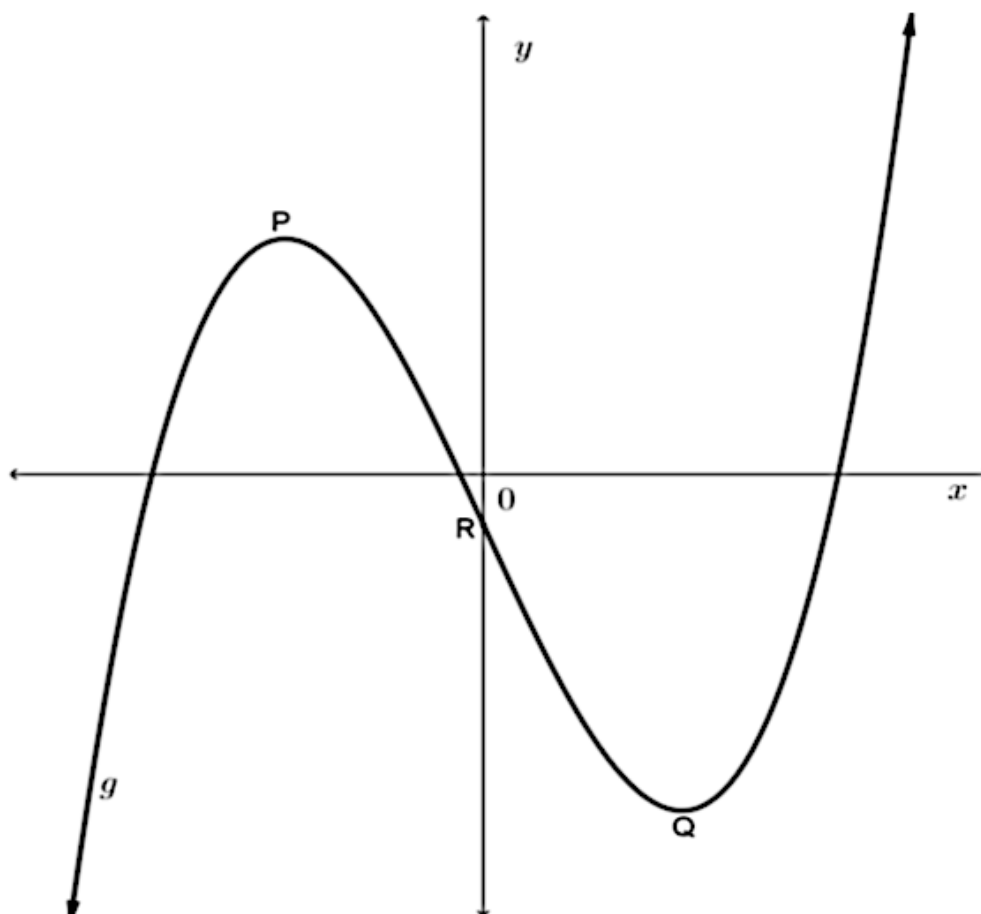
8.1.1 Determine $f'(x)$ from first principles. (5)

8.1.2 $y = 12x - 8$ is a tangent to the graph of f at A. Calculate the coordinates of A. (3)

Mpumalanga Pre-Trial 2026

QUESTION 9

The sketch below shows the graph of $g(x) = x^3 - 6x - 1$. P and Q are the turning points and R the y-intercept of g .



- 9.1 Determine the coordinates of R. (2)
- 9.2 Determine the coordinates of the turning points P and Q. (6)
- 9.3 If $h(x) = g'(x)$, determine for which values of x is $h(x) \leq 0$. (2)
- 9.4 Determine the equation of the tangent to g at R. (3)
- 9.5 Write down the equation of the line perpendicular to the tangent at P. (2)
- 9.6 Calculate the values of x for which g strictly increases as x increases. (2)

[17]

FINANCIAL MATHEMATICS

Mpumalanga Mock Exam 2026

7.1

The Mpumalanga Department of Education bought 50 tablets for a total amount of R800 000 in order for teachers to do a coding course in the province.

Calculate:

- 7.1.1 the price of one tablet (1)
- 7.1.2 the book value of a tablet after 3 years, if the rate of depreciation is 18% p.a. on the reducing-balance method. (2)
- 7.1.3 the number of years it would take for the price of a tablet to be R21 200, if the rate of inflation is 5,8% p.a. compounded annually. (Answer to the nearest year.) (3)

Western Cape Trial 2026

QUESTION 7

- 7.1 Susan invests a lump sum of R50 000 in a savings account for 6 years. The investment earns 9,35% p.a., compounded quarterly.
 - 7.1.1 Determine the effective interest rate. (3)
 - 7.1.2 Calculate the value of Susan's investment after 6 years. (2)

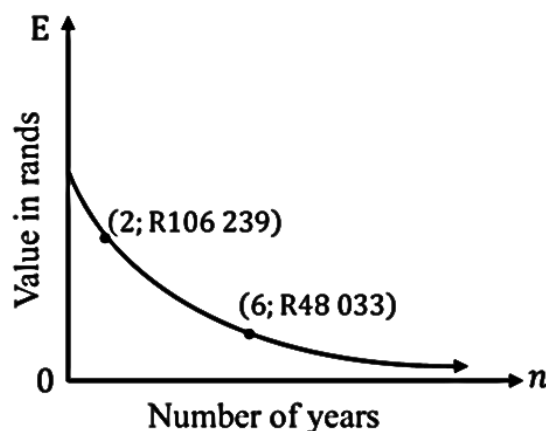
Northern Cape 2024

- 7.1 On the 1 April 2019, Lebere deposited R5 000 into a savings account at an interest rate of $r\%$ per annum, compounded quarterly.
 - 7.1.1 On 1 April 2023, the amount in the savings account was R12 980. Calculate r . (3)
 - 7.1.2 He used R7 580 of the money to buy a new laptop. The value of the laptop depreciated at a rate of 22% per annum, according to the reducing balance method. After how many years will its book value be R1 707? (3)

- 7.2 Andy takes up a loan of R850 000. The loan is repaid over 20 years at 8,5% p.a., compounded monthly.
- 7.2.1 Calculate the value of Andy's monthly instalment. (4)
- 7.2.2 Calculate how much Andy will still owe the bank after his 26th payment (3)
- 7.2.3 Hence, calculate the total interest Andy will have paid over the first 26 months (2)
- [15]**

Western Cape Trial 2024

- 6.1 Determine how long it will take for an investment of R20 000 to grow to R45 000 in an account earning interest at 7,5% p.a., compounded monthly. Give your answer to the nearest month. (3)
- 6.2 The depreciation of office equipment is represented by the graph below. E is the value of the equipment in Rands and n is the number of years the equipment is being used.



- 6.2.1 What does the y-intercept of the graph indicate? (1)
- 6.2.2 According to this model, will the value of the equipment ever become R0? Explain your answer. (1)
- 6.2.3 Calculate the annual rate of depreciation. (3)
- 6.3 Herman plans to purchase a house for R2 464 000. He will take out a loan for the full amount for 30 years at 10,2% p.a., compounded monthly.
- 6.3.1 Calculate what his instalments will be if he is required to repay the bank equal amounts at the end of each month. (4)
- 6.3.2 Instead of paying the bank-stipulated amount calculated in QUESTION 6.3.1, Herman decides to repay the loan by R22 500 instead, at the end of every month. Calculate the balance outstanding on the loan immediately after he pays his 84th payment. (3)

Sinking Fund

A farmer has just bought a new tractor for R800 000. He has decided to replace the tractor in 5 years' time, when its trade-in value will be R200 000. The replacement cost of the tractor is expected to increase by 8% per annum.

7.2.1 The farmer wants to replace his present tractor with a new one in 5 years' time. The farmer wants to pay cash for the new tractor, after trading in his present tractor for R200 000. How much will he need to pay? **(3)**

7.2.2

- One month after purchasing his present tractor, the farmer deposited x rands into an account that pays interest at a rate of 12% p.a., compounded monthly.
- He continued to deposit the same amount at the end of each month for a total of 60 months.
- At the end of 60 months he has exactly the amount that is needed to purchase a new tractor, after he trades in his present tractor.

Calculate the value of x . **(6)**

PROBABILITY

Probability Rules

QUESTION 2

The events A and B are independent. $P(A) = 0,4$ and $P(B) = 0,5$

Determine:

- 2.1 $P(A \text{ and } B)$ (2)
 - 2.2 $P(A \text{ or } B)$ (2)
 - 2.3 $P(\text{not } A \text{ and not } B)$ (3)
- [7]**

Activity 4

A and B are mutually exclusive events. If it is given that the $P(A) = 0,35$ and $P(B) = 0,52$, determine:

- 4.1 $P(A')$ (2)
 - 4.2 $P(A \text{ and } B)$ (3)
 - 4.3 $P(A \text{ or } B)$ (4)
- [9]**

QUESTION 11

11.1 Mandisa is visiting a restaurant. The probability that she will order tea is 0,4 and the probability that she will order cake is 0,5. The probability that she will order tea or cake is 0,8.

11.1.1 Calculate the probability that:

- (a) Mandisa will order neither tea nor cake (1)
- (b) She will order tea and cake (2)

11.1.2 Let T and C represent the events of Tea and Cake respectively. Are the events T and C mutually exclusive? Motivate your answer.

(2)

Contingency Table

QUESTION 8

8.1 A study on eating chocolate and gender yielded the following results.

	Eating Chocolate	Not Eating Chocolate	TOTAL
Male	45	25	70
Female	35	45	80
TOTAL	80	70	150

8.1.1 How many people participated in this study? (1)

8.1.2 Calculate the following probabilities:

(a) $P(\text{male})$ (1)

(b) $P(\text{Eating Chocolate})$ (1)

8.1.3 Are the events being a male and eating chocolate independent? Justify your answer with relevant calculations. (3)

QUESTION 10

10.1 Each passenger on a certain Banana Airways flight chose exactly one beverage from tea, coffee or fruit juice. The results are shown in the table below.

	MALE	FEMALE	TOTAL
Tea	20	40	60
Coffee	b	c	80
Fruit juice	d	e	20
TOTAL	60	100	a

10.1.1 Write down the value of a . (1)

10.1.2 What is the probability that a randomly selected passenger is male? (2)

10.1.3 Given that the event of a passenger choosing coffee is independent of being a male, calculate the value of b . (4)

Tree Diagrams

QUESTION 11

- 11.1 A bag of balls contains 7 green balls and 5 yellow balls. Sihle randomly selects two balls from the bag, one at a time, and without replacing the first one.
- 11.1.1 Draw a tree diagram to illustrate all possible outcomes. (3)
- 11.1.2 Determine the probability that she selects one yellow and one green ball, in any order. (3)

QUESTION 8

- 8.1 A bag contains 3 blue marbles and 2 red marbles. A marble is taken from the bag, the colour is recorded and the marble is put aside. A second marble is taken from the bag, the colour is recorded and then put aside.
- 8.1.1 Draw a tree diagram to represent the information above. Show the probabilities associated with EACH branch, as well as the possible outcomes. (3)
- 8.1.2 Determine the probability of first taking a red marble and then taking a blue marble, in that order. (2)

Venn Diagrams

QUESTION 9

A survey was done among 80 learners on their favourite sport. The results are shown below.

- 52 learners like rugby (R)
- 42 learners like volleyball (V)
- 5 learners like chess (C) only
- 14 learners like rugby and volleyball but not chess
- 12 learners like rugby and chess but not volleyball
- 15 learners like volleyball and chess but not rugby
- x learners like all 3 types of sport
- 3 learners did not like any sport

- 9.1 Draw a Venn diagram to represent the information above. (5)
- 9.2 Show that $x = 8$. (2)
- 9.3 How many learners like only rugby? (1)
- 9.4 Calculate the probability that a learner, chosen randomly, likes at least TWO different types of sport. (3)

QUESTION 11

11.1 Zebra High School offers only two sporting activities, namely rugby and hockey.

The following information is given:

- There are 600 learners in the school.
- 372 learners play hockey.
- 288 learners play rugby.
- 56 of the learners play NO sport.
- The number of learners that play both hockey and rugby is x .

11.1.1 Represent the given information in a Venn diagram, in terms of x . (3)

11.1.2 Calculate the value of x . (2)

11.1.3 Are the events playing rugby and playing hockey mutually exclusive? Justify your answer. (2)

Fundamental Counting Principle

QUESTION 11

11.2 Ten runners, A to J, complete a race.

11.2.1 In how many different orders can the 10 runners finish the race? (1)

11.2.2 In how many of the possible arrangements do A, B and C finish in the first three positions, regardless of the order? (2)

11.2.3 In how many different ways can the gold, silver and bronze medals be awarded to the 10 runners? (2)

11.2.4 Determine the probability that H and G do not finish consecutively. (4)
[15]

QUESTION 11

11.2 A seven-unit bar code is designed in such a way that the first four places are letters (excluding the vowels: A, E, I, O and U) and the last three places are filled with the digits 1 to 9. Letters and numbers may **not** be repeated.

11.2.1 How many different bar codes can be generated? (2)

11.2.2 Find the probability that the bar code will begin with the letter A and the three-digit number formed using the last three places will be divisible by 5. (3)

11.3 The letters of the word SYLLABUS are used to form different eight-letter codes. Determine the probability that the code formed will start and end with the same letters. Leave your answer as a simplified common fraction. (6)

STATISTICS

North West Trial 2026

QUESTION 1

A survey was done under 100 members of a gymnasium about the cost of their annual membership contract.

Results showed an average annual payment of R3 240.

AMOUNT (R)	FREQUENCY
$0 \leq x < 1000$	8
$1000 \leq x < 2000$	12
$2000 \leq x < 3000$	P
$3000 \leq x < 4000$	30
$4000 \leq x < 5000$	Q
$5000 \leq x < 6000$	12

- 1.1 How many members payed less than R2 000 for their annual contract? (1)
 - 1.2 Proof by calculation that $P = 20$ and $Q = 18$. (5)
 - 1.3 Hence, complete the cumulative frequency table in the ANSWER BOOK. (2)
 - 1.4 Use the cumulative frequency table to draw an ogive to illustrate the information above. (3)
 - 1.5 Use the ogive to determine how many members spent more than R4 200 annually on their contracts. (1)
- [12]**

North West Trial 2026

QUESTION 2

Eight couples entered a dance competition. Two judges gave marks for their performances. The marks (out of 20) are shown in the table below.

COUPLE	1	2	3	4	5	6	7	8
JUDGE 1	18	4	6	8	5	12	10	14
JUDGE 2	15	6	3	5	5	14	8	15

- 2.1 Determine the equation of the least squares regression line of the marks given by the two judges. (3)
 - 2.2 A ninth couple had a late entry in the competition and received a mark of 15 by JUDGE 1. Calculate to the nearest integer, the mark they possibly would have received from JUDGE 2. (2)
 - 2.3 Are the judges consistent when allocating marks?
Motivate your answer with appropriate calculations. (3)
- [8]**

Ogive

QUESTION 4

Thirty learners were asked to answer a question in Mathematics. The time taken, in minutes, to answer the question correctly, is shown in the frequency table below.

TIME, t (IN MINUTES)	NUMBER OF LEARNERS
$1 \leq t < 3$	3
$3 \leq t < 5$	6
$5 \leq t < 7$	7
$7 \leq t < 9$	8
$9 \leq t < 11$	5
$11 \leq t < 13$	1

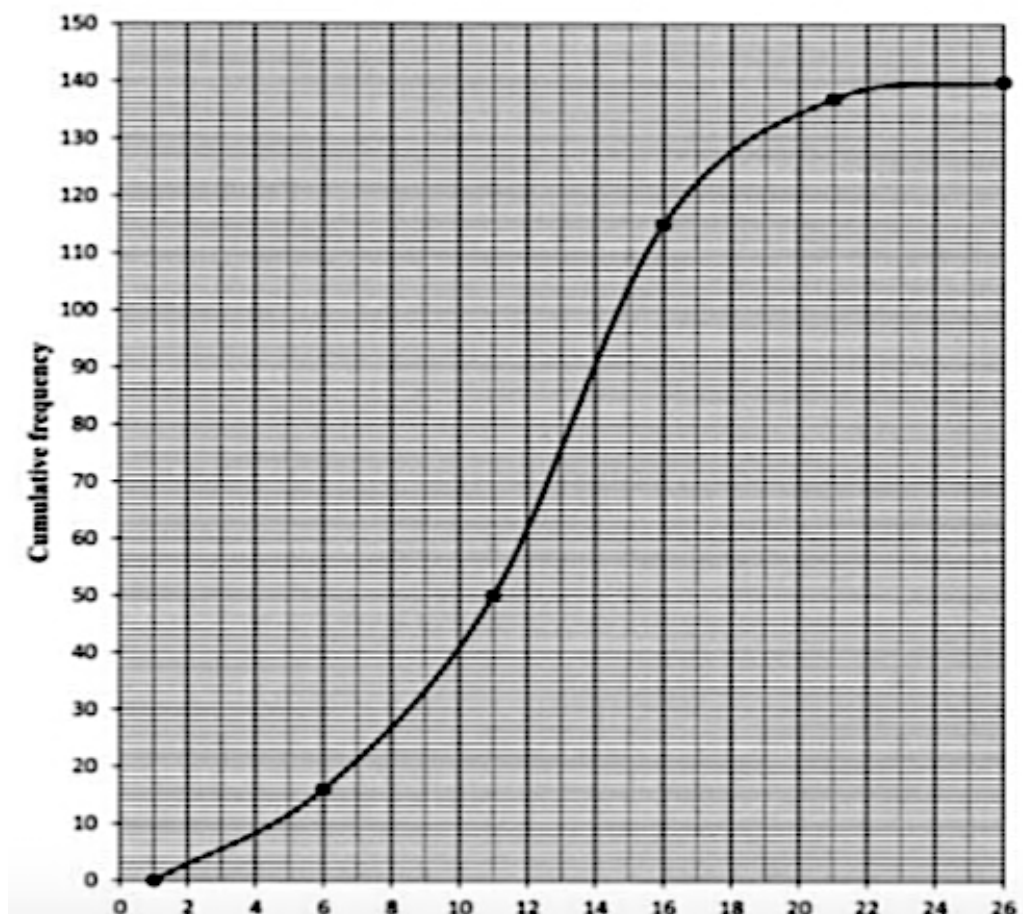
- 4.1 Construct a cumulative frequency table for the data. (3)
 - 4.2 Draw a cumulative frequency graph (ogive) of the above data on the grid provided on DIAGRAM SHEET 1. (4)
 - 4.3 If a learner answers the question correctly in less than 4 minutes, then he/she is classified as a 'gifted learner'. Estimate the percentage of 'gifted learners' in this group. (2)
- [9]**

Eastern Cape Trial 2023

QUESTION 3

The cumulative frequency curve (ogive) drawn below shows the time taken (in minutes) for 140 patrons to leave an auditorium after watching a show.

Cumulative frequency curve showing the time taken to leave an auditorium



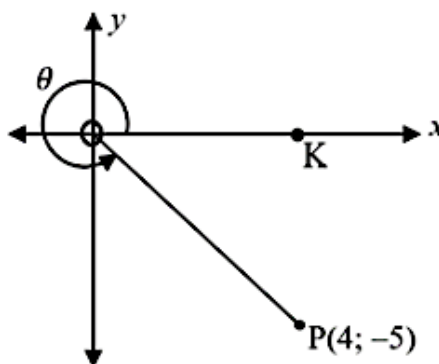
- 3.1 Estimate the number of people who took more than 15 minutes to leave the auditorium. (2)
 - 3.2 Estimate the number of people who took between 8 and 12 minutes to leave the auditorium. (2)
 - 3.3 Write down the modal class for the data. (1)
- [5]**

TRIGONOMETRY

Nort West Trial 2026

QUESTION 5

5.1 In the diagram below, line OP is given with $P(4; -5)$. $\hat{KOP} = \theta$



Calculate, **without using a calculator**, the numerical value of the following:

5.1.1 $\sin^2(180^\circ + \theta)$ (4)

5.1.2 $\tan(-\theta)$ (2)

5.2 Calculate, **without using a calculator**, the value of the following:

5.2.1 $\cos 15^\circ$ (6)

5.2.2
$$\frac{\cos(90^\circ + x) \cdot \cos(180^\circ - x)}{\cos^2(180^\circ + x) \cdot \tan(180^\circ - x)}$$
 (5)

5.3 Given:
$$\frac{\sin 2\theta + 2 \cos \theta - 2 \cos^3 \theta}{1 + \sin \theta} = \sin 2\theta$$

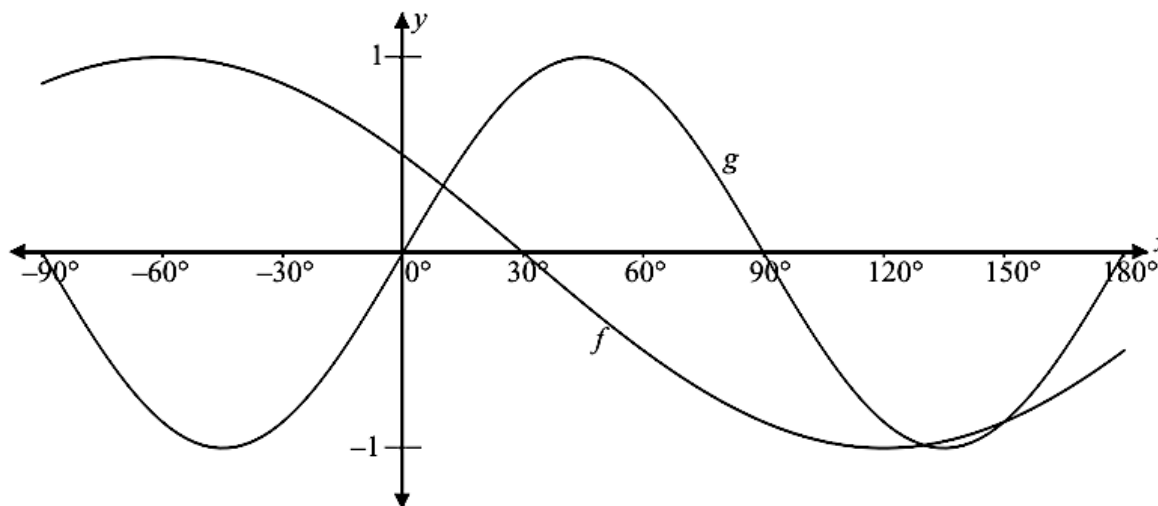
5.3.1 Proof the identity. (5)

5.3.2 For which values of θ in the interval $[-360^\circ; 360^\circ]$ is the identity in QUESTION 5.3.1 undefined? (2)

5.4 Calculate the maximum value of $\frac{4}{2 + \cos x}$ (2)
[26]

QUESTION 6

In the diagram below, the graphs of $f(x) = \cos(x + 60^\circ)$ and $g(x) = \sin 2x$ are drawn for the interval $x \in [-90^\circ; 180^\circ]$.



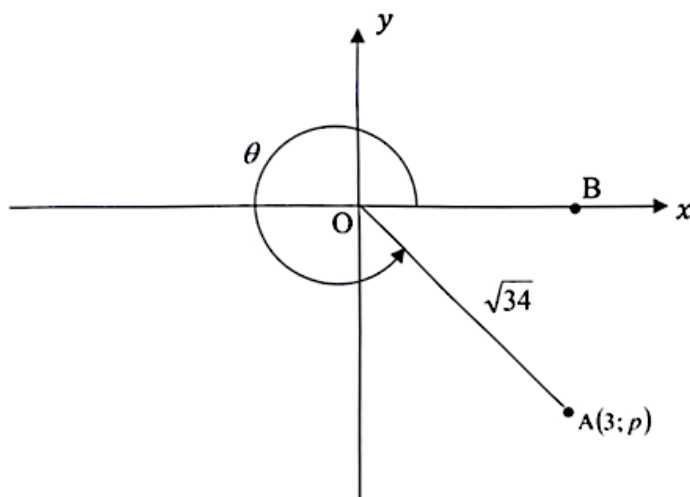
- 6.1 Calculate the values of x , in the interval $x \in [-90^\circ; 180^\circ]$ for which $f(x) = g(x)$. (7)
 - 6.2 Write down the period of $g(x)$. (1)
 - 6.3 Use your answer in question 6.1 to determine the value(s) of x where $g(x) \geq f(x)$. (2)
 - 6.4 Describe the transformation from h to p if $h(x) = \sin x$ and $p(x) = \sin(x - 30^\circ)$. (3)
- [13]**

Mpumalanga Trial 2026

QUESTION 5

- 5.1 Given: $\sin(P - Q) = \sin P \cos Q - \cos P \sin Q$. Use the formula given to derive a formula for $\cos(P + Q)$. (3)

- 5.2 In the diagram below, $A(3;p)$ is a point in the Cartesian plane. $OA = \sqrt{34}$ and $\widehat{BOA} = \theta$, which is a reflex angle.



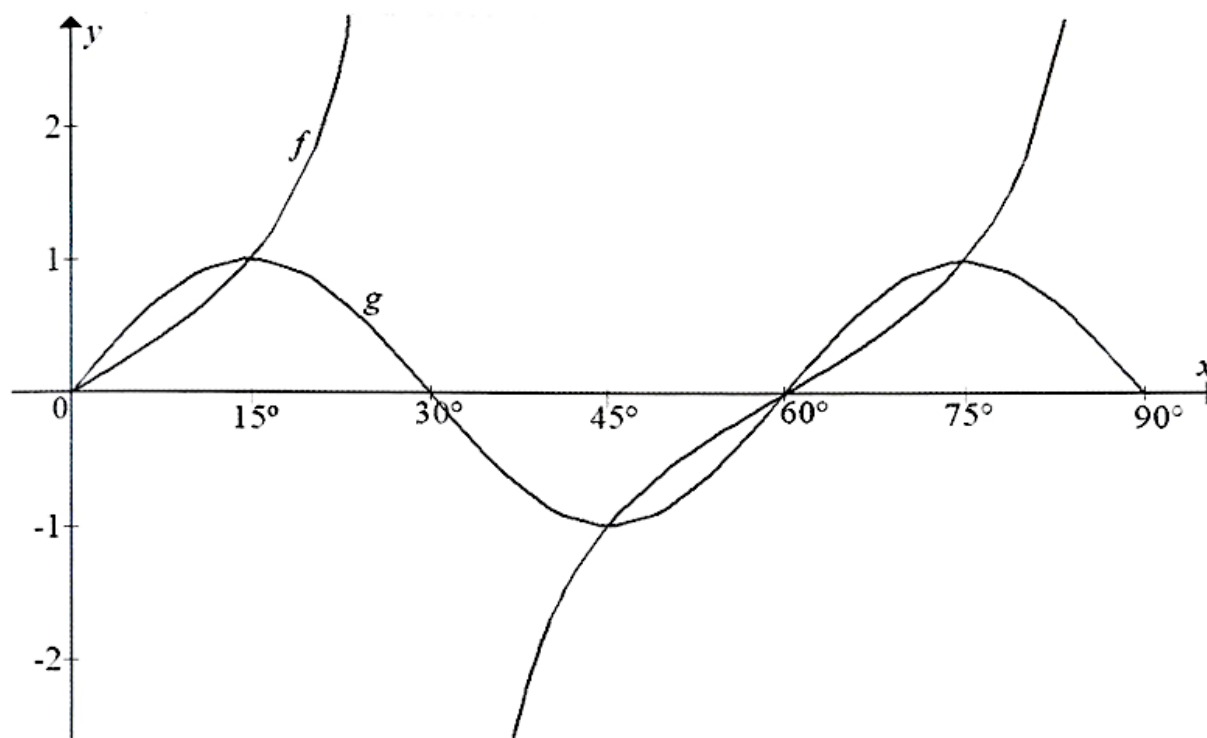
Determine **without using a calculator** the value of:

- 5.2.1 p (2)
- 5.2.2 $\cos(60^\circ + \theta)$ (4)
- 5.3 Determine the value of k :
 $\sin 50^\circ = \sin 145^\circ \cos(360^\circ - k) - \cos(k + 90^\circ) \cos(-35^\circ)$ if $0^\circ \leq k \leq 90^\circ$. (5)
- 5.4 Prove that: $4\cos\theta - \frac{1 + \cos 2\theta}{\cos\theta} = \frac{\sin 2\theta}{\sin\theta}$ (4)
- 5.5 Determine the general solution of $2\cos x = 3\tan x$ (6)
- 5.6 Determine the value of $3 - 4\sin^2 22,5^\circ$ **without using a calculator**. (4)

[28]

QUESTION 6

- 6.1 On the set of axes, the graphs of $f(x) = \tan 3x$ and $g(x) = \sin 6x$ are shown for the interval $x \in [0^\circ; 90^\circ]$.



- 6.1.1 Write down the period of f . (1)
- 6.1.2 Write down the equations of the asymptotes of f , in the interval $x \in [0^\circ; 90^\circ]$. (2)
- 6.1.3 Determine using the graphs the values of x for which $f(x) \leq g(x)$ in the interval $x \in [0^\circ; 60^\circ]$. (2)
- 6.2 Given: $h(x) = \sin(6x - 60^\circ)$
- 6.2.1 Describe how the graph of h is obtained by translating the graph of $y = \sin 6x$. (2)
- 6.2.2 Write down the range of $p(x) = -2h(x) + 1$ (3)

[10]

Eastern Cape Trial 2026

QUESTION 5

5.1 Given: $\sin 49^\circ = q$, determine the following in terms of q :

5.1.1 $\tan 41^\circ$ (2)

5.1.2 $\cos 229^\circ$ (2)

5.1.3 $\sin 4^\circ$ (4)

5.2 Given: $f(x) = \frac{\sin(x-180^\circ) \cdot \sin(90^\circ + x)}{\sin^2 x - \cos^2(360^\circ - x)}$

5.2.1 Simplify $f(x)$ to a one trigonometric ratio of x . (7)

5.2.2 For which values of $x \in [-180^\circ + 0^\circ]$, is $f(x)$ undefined? (2)

[17]

QUESTION 6

6.1 Given: $\cos(A-B) = \cos A \cos B + \sin A \sin B$

Use the formula given above to derive a formula for $\cos(A+B)$ (3)

6.2 Without using a calculator, prove that

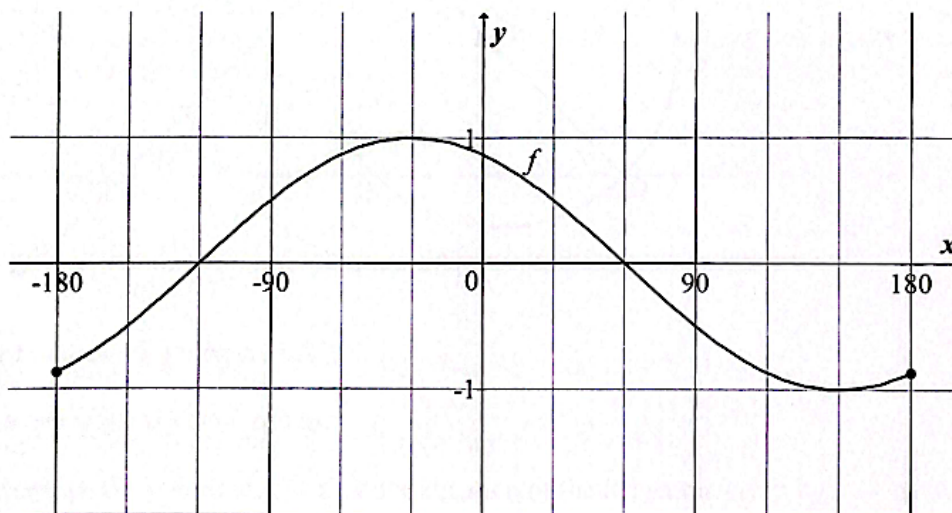
$$\frac{\sin 22^\circ \cdot \cos 320^\circ + \sin 40^\circ \sin 68^\circ}{\sin 391^\circ \cdot \cos 31^\circ} = 2 \quad (6)$$

6.3 It is given that $\cos 2x + 5 \sin x = 3$. Determine the values of x in the interval where $-360^\circ \leq x \leq 0^\circ$ (5)

[14]

QUESTION 7

Given: $f(x) = a \cos(x + p)$ where $x \in [-180^\circ; 180^\circ]$



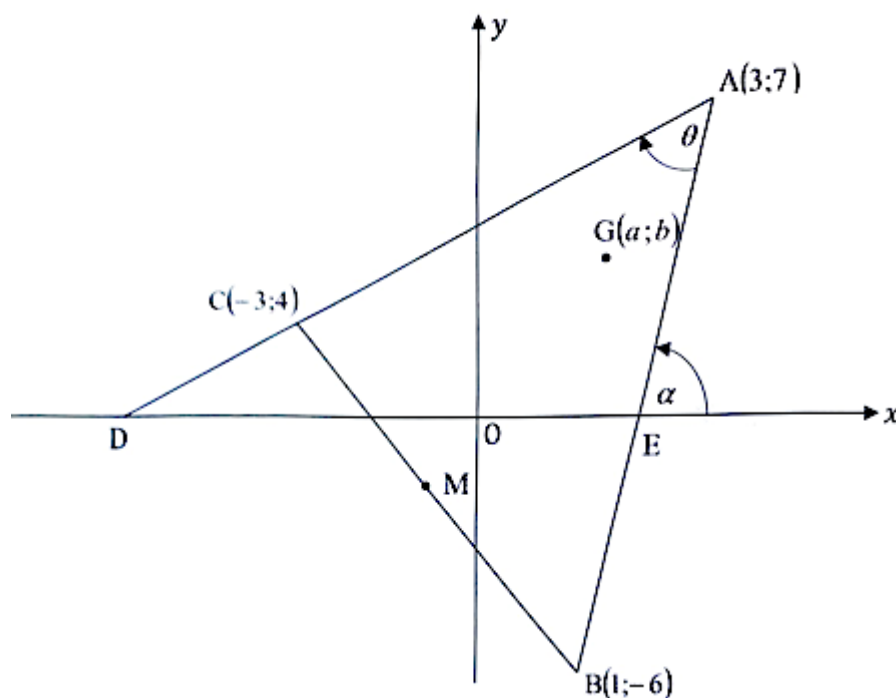
- 7.1 Determine the values of a and p . (2)
 - 7.2 Write down the period of f (1)
 - 7.3 Sketch the graph of $g(x) = -\sin x$, where $x \in [-180^\circ; 180^\circ]$ on the grid provided in the ANSWER BOOK. Clearly indicate intercepts with the axes. (3)
 - 7.4 Write down the values of x where $g(x) = f(x)$ in the interval $x \in [-180^\circ; 180^\circ]$. (2)
 - 7.5 Determine the range of h , if $h(x) = -g(x) - 2$. (2)
- [10]**

ANALYTICAL GEOMETRY

Mpumalanga Trial 2026

Question 1

In the diagram below, $A(3; 7)$, $B(1; -6)$ and $C(-3; 4)$ are the vertices of $\triangle ABC$. M is the midpoint of BC . AC is extended to cut the x -axis at D , and AB cuts the x -axis at E . The angles θ and α are shown on the diagram. G is the point $(a; b)$

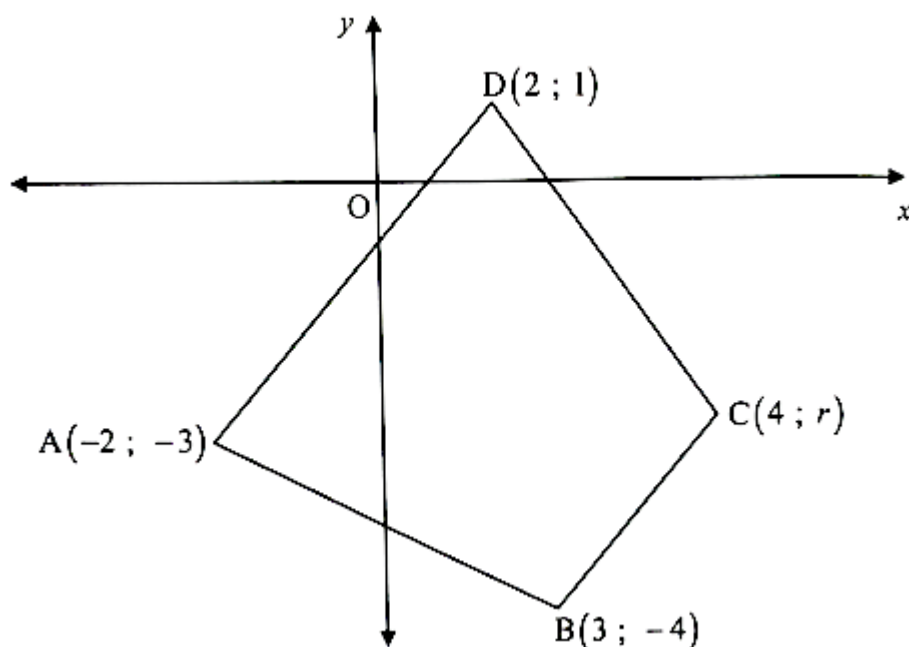


- 1.1 Calculate the gradient of AD . (2)
- 1.2 Determine the equation of AC . (2)
- 1.3 Determine the length of AD . Leave your answer in simplest surd form. (4)
- 1.4 Determine the coordinates of M . (2)
- 1.5 Calculate the size of θ rounded off to the nearest degree. (5)
- 1.6 If the points A , G and M are collinear and calculate the possible values of b and a . (6)

Limpopo Trial 2026

Question 2

In the diagram $A(-2; -3)$, $B(3; -4)$, $C(4; r)$ and $D(2; 1)$ are vertices of quadrilateral ABCD

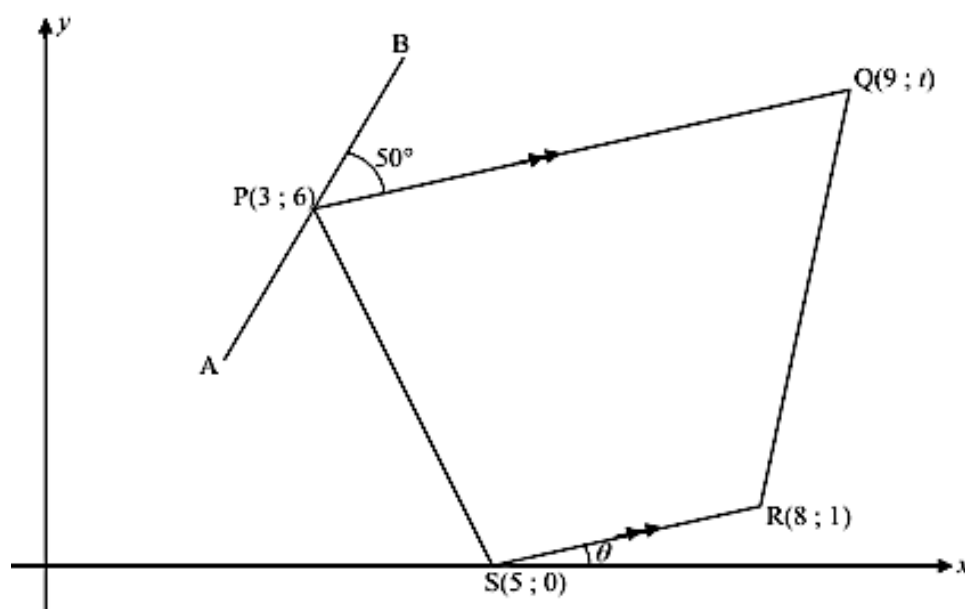


- 2.1 Calculate the coordinates of M, the midpoint of AD. (2)
- 2.2 Determine the equation of BM, the median of $\triangle ABD$. (3)
- 2.3 Prove that $BM \perp AD$. (2)
- 2.4 Determine the value of r if $AD \parallel BC$. (3)
- 2.5 Calculate the size of the angle that BD forms with the positive x— axis. (4)
- 2.6 Calculate the coordinates of S, the point of intersection of AC and BD. (5)
- 2.7 Prove that $\triangle ABD$ is isosceles. (4)
- 2.8 State, with a reason, what type of quadrilateral is ABCD? (2)

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Question 3

In the diagram below PQRS is a quadrilateral with vertices $P(3; 6)$, $Q(9; t)$, $R(8; 1)$ and $S(5; 0)$. $PQ \parallel SR$. AB is a straight line that touches the quadrilateral at P. $QPB = 50^\circ$



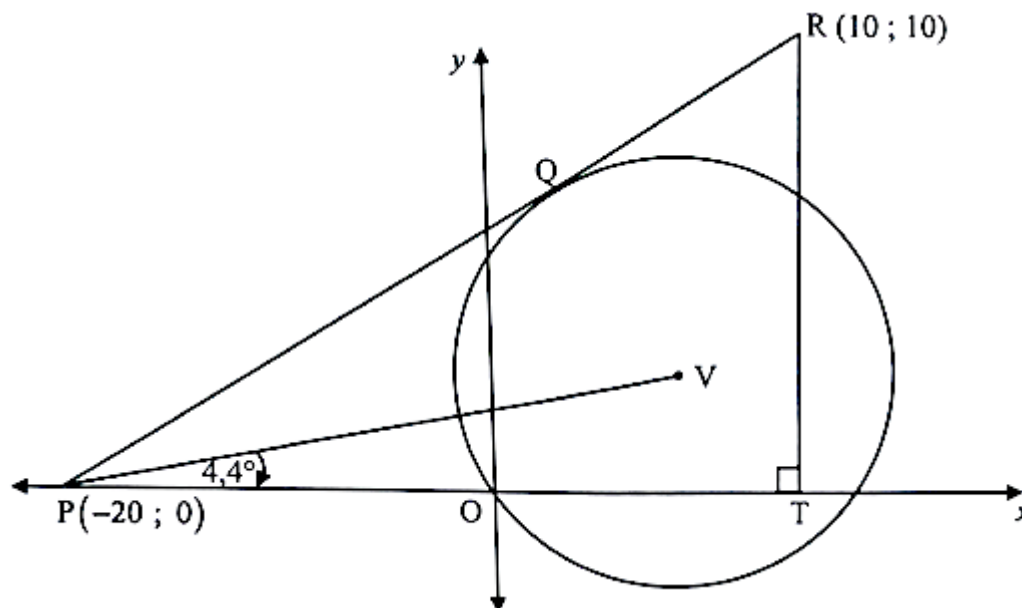
- 3.1 Calculate the gradient of SR. (2)
- 3.2 Determine the equation of PQ in the form $y = mx + c$ (3)
- 3.3 Calculate the value of t . (2)
- 3.4 Calculate the length of PQ if $t = 8$. (2)
- 3.5 Prove that PS is perpendicular to SR. (3)
- 3.6 If $PQ = PS$, calculate the area of PQRS. (6)
- 3.7 Calculate the value of θ , the angle of inclination of SR. (2)
- 3.8 Calculate the equation of AB. Show ALL working. (6)

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Question 4

In the diagram, PR is a tangent to circle, with centre V, at Q. The equation of PR is.

$y = \frac{1}{3}x + \frac{20}{3}$. RT is parallel to the y-axis. The circle passes through the origin. $VPT = 4^\circ$ and $PQ = 8\sqrt{10}$

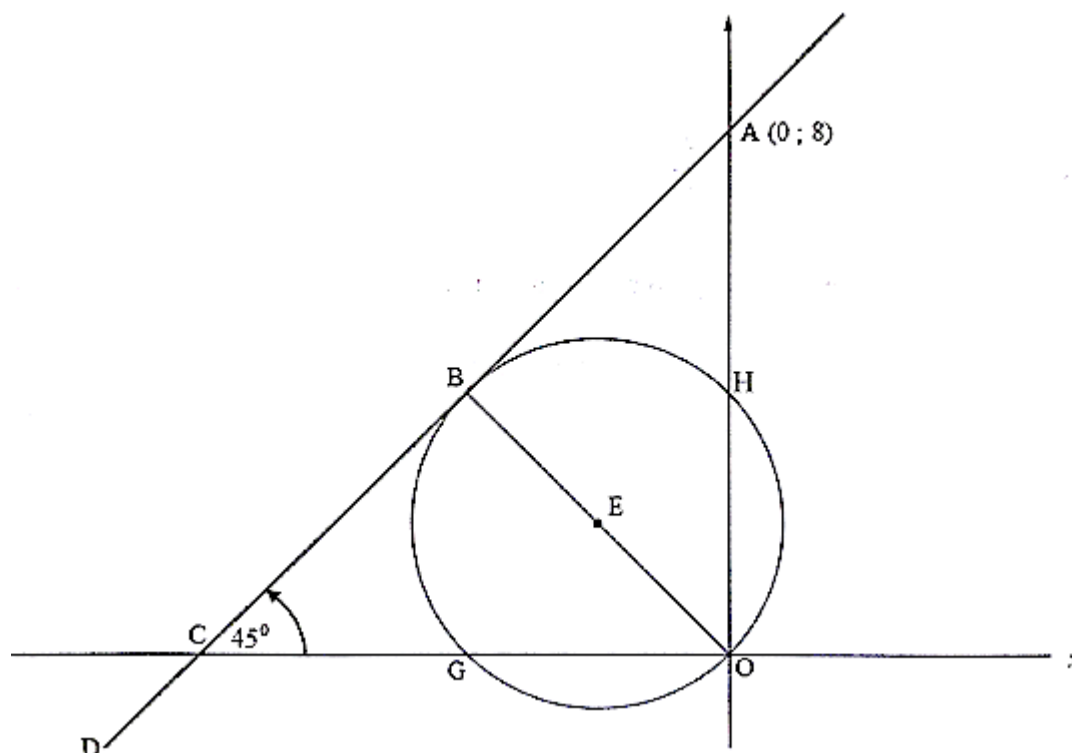


- 4.1 Calculate the length of the radius of the circle. (4)
- 4.2 Hence calculate the length of the radius of the circle (3)
- 4.3 The point V is 4 units left of RT. Determine the coordinates of the centre of the circle, rounded off to the nearest whole number. (4)
- 4.4 Determine the coordinates of S if PVT is a parallelogram. (2)

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Question 5

A circle with centre E passes through the origin. The circle intersects the x-axis at G and the y-axis at H. The tangent to the circle at B cuts the y-axis at A (0; 8) and forms an angle of 45° with the x-axis.



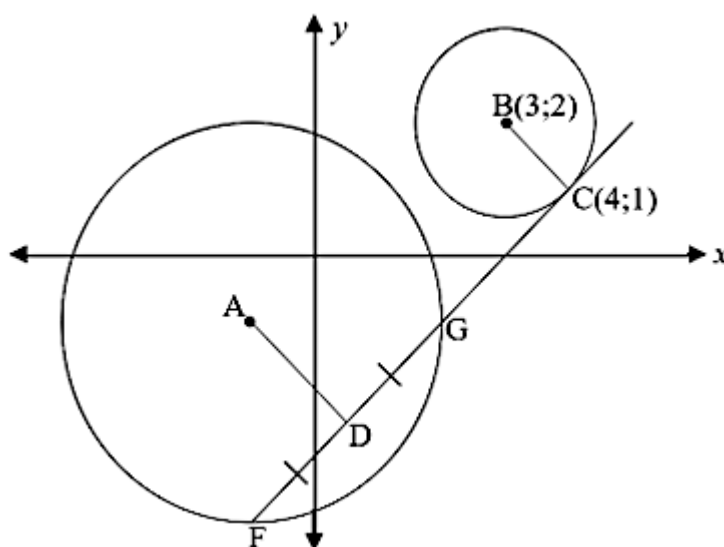
- 5.1 Write down the gradient of AD.
- 5.2 Determine the equation of OB.
- 5.3 Determine the coordinates of B, if the equation of the tangent is given by:
 $y = x + 8$
- 5.4 Calculate the length of the radius of the circle.
- 5.5 Determine the equation of the circle in the form $(x - a)^2 + (y - b)^2 = r^2$
- 5.6 For which values of t will the equation $y = x + t$ be a tangent to the circle?
- 5.7 Another circle with equation $(x - 4)^2 + (y - 8)^2 = 9$ is given. Determine whether the TWO circles touch each other or not. Justify your answer

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Question 6

In the diagram below the circle with centre A has the equation.

$(x + 1)^2 + (y + 1)^2 = 9$. FG is a chord of circle A. AD bisects chord FG. FGC is a tangent to the circle with centre B(3; 2) at point C(4; 1).



- 6.1 Write down the coordinates of A. (1)
- 6.2 Determine the equation of tangent FC, in the form. $Y = mx + c$ (4)
- 6.3 Given: $AD = \frac{\sqrt{10}}{2}$ units. Calculate the length of FG. (4)
- 6.4 Determine the length of AB. (2)
- 6.5 Another circle with centre B, touches the circle with centre A at K. Determine the equation of the new circle. (3)

ACCEPTABLE REASONS: EUCLIDEAN GEOMETRY (ENGLISH)

THEOREM STATEMENT	ACCEPTABLE REASON(S)
LINES	
The adjacent angles on a straight line are supplementary.	$\angle$ s on a str line
If the adjacent angles are supplementary, the outer arms of these angles form a straight line	adj $\angle$ s supp
The adjacent angles in a revolution add up to 360° .	$\angle$ s round a pt OR $\angle$ s in a rev
Vertically opposite angles are equal.	vert opp $\angle$ s =
If $AB \parallel CD$, then the alternate angles are equal.	alt $\angle$ s; $AB \parallel CD$
If $AB \parallel CD$, then the corresponding angles are equal	corresp $\angle$ s; $AB \parallel CD$
If $AB \parallel CD$, then the co-interior angles are supplementary.	co-int $\angle$ s; $AB \parallel CD$
If the alternate angles between two lines are equal, then the lines are parallel.	Alt $\angle$ s =
If the corresponding angles between two lines are equal, then the lines are parallel.	corresp $\angle$ s =
If the co-interior angles between two lines are supplementary, then the lines are parallel.	co-int $\angle$ s supp
TRIANGLES	
The interior angles of a triangle are supplementary	$\angle$ sum in Δ OR sum of $\angle$ s in Δ OR Int $\angle$ s Δ
The exterior angle of a triangle is equal to the sum of the interior opposite angles	Ext $\angle$ of Δ
The angles opposite the equal sides in an isosceles triangle are equal.	$\angle$ s opp equal sides
The sides opposite the equal angles in an isosceles triangle are equal	Sides opp equal $\angle$ s
In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.	Pythagoras OR Theorem of Pythagoras
If the square of the longest side in a triangle is equal to the sum of the squares of the other two sides then the triangle is right-angled.	Converse Pythagoras OR Converse Theorem of Pythagoras
If three sides of one triangle are respectively equal to three sides of another triangle, the triangles are congruent	SSS
If two sides and an included angle of one triangle are respectively equal to two sides and an included angle of another triangle, the triangles are congruent.	SAS OR S $\angle$ S
If two angles and one side of one triangle are respectively equal to two angles and the corresponding side in another triangle, the triangles are congruent.	AAS OR $\angle\angle$ S
If in two right angled triangles, the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and one side of the other, the triangles are congruent	RHS OR 90° HS
The line segment joining the midpoints of two sides of a triangle is parallel to the third side and equal to half the length of the third side	Midpt Theorem
The line drawn from the midpoint of one side of a triangle, parallel to another side, bisects the third side.	line through midpt $\parallel$ to 2nd side
A line drawn parallel to one side of a triangle divides the other two sides proportionally.	line $\parallel$ one side of Δ OR prop theorem; name $\parallel$ lines
If a line divides two sides of a triangle in the same proportion, then the line is parallel to the third side.	line divides two sides of Δ in prop
If two triangles are equiangular, then the corresponding sides are in proportion (and consequently the triangles are similar)	$\parallel\parallel\parallel$ Δ s OR equiangular Δ s
If the corresponding sides of two triangles are proportional, then the triangles are equiangular (and consequently the triangles are similar)	Sides of Δ in prop
If triangles (or parallelograms) are on the same base (or on bases of equal length) and between the same parallel lines, then the triangles (or parallelograms) have equal areas.	same base; same height OR equal bases; equal height

CIRCLES	
The tangent to a circle is perpendicular to the radius/diameter of the circle at the point of contact.	$\text{tan} \perp \text{radius OR } \text{tan} \perp \text{diameter}$
If a line is drawn perpendicular to a radius/diameter at the point where the radius/diameter meets the circle, then the line is a tangent to the circle.	$\text{line} \perp \text{radius OR converse } \text{tan} \perp \text{radius OR converse } \text{tan} \perp \text{diameter}$
The line drawn from the centre of a circle to the midpoint of a chord is perpendicular to the chord	line from centre to midpt of chord
The line drawn from the centre of a circle perpendicular to a chord bisects the chord	line from centre $\perp$ to chord
The perpendicular bisector of a chord passes through the centre of the circle;	perp bisector of chord
The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (on the same side of the chord as the centre)	$\angle \text{ at centre} = 2 \times \angle \text{ at circumference}$
The angle subtended by the diameter at the circumference of the circle is 90° .	$\angle \text{ s in semi circle OR diameter subtends right angle OR } \angle \text{ in } \frac{1}{2} \odot$
If the angle subtended by a chord at the circumference of the circle is 90° , then the chord is a diameter.	chord subtends 90° OR converse $\angle \text{ s in semi circle}$
Angles subtended by a chord of the circle, on the same side of the chord, are equal	$\angle \text{ s in the same seg}$
If a line segment joining two points subtends equal angles at two points on the same side of the line segment, then the four points are concyclic.	line subtends equal $\angle \text{ s OR converse } \angle \text{ s in the same seg}$
Equal chords subtend equal angles at the circumference of the circle	equal chords; equal $\angle \text{ s}$
Equal chords subtend equal angles at the centre of the circle.	equal chords; equal $\angle \text{ s}$
Equal chords in equal circles subtend equal angles at the circumference of the circles	equal circles; equal chords; equal $\angle \text{ s}$
Equal chords in equal circles subtend equal angles at the centre of the circles.	equal circles; equal chords; equal $\angle \text{ s}$
The opposite angles of a cyclic quadrilateral are supplementary	opp $\angle \text{ s of cyclic quad}$
If the opposite angles of a quadrilateral are supplementary then the quadrilateral is cyclic	opp $\angle \text{ s quad supp OR converse opp } \angle \text{ s of cyclic quad}$
The exterior angle of a cyclic quadrilateral is equal to the interior opposite angle.	ext $\angle \text{ of cyclic quad}$
If the exterior angle of a quadrilateral is equal to the interior opposite angle of the quadrilateral, then the quadrilateral is cyclic.	ext $\angle = \text{int opp } \angle \text{ OR converse ext } \angle \text{ of cyclic quad}$
Two tangents drawn to a circle from the same point outside the circle are equal in length	Tans from common pt OR Tans from same pt
The angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment.	tan chord theorem
If a line is drawn through the end-point of a chord, making with the chord an angle equal to an angle in the alternate segment, then the line is a tangent to the circle.	converse tan chord theorem OR $\angle \text{ between line and chord}$

QUADRILATERALS	
The interior angles of a quadrilateral add up to 360° .	sum of $\angle \text{ s in quad}$
The opposite sides of a parallelogram are parallel.	opp sides of $\parallel \text{ m}$
If the opposite sides of a quadrilateral are parallel, then the quadrilateral is a parallelogram	opp sides of quad are $\parallel$
The opposite sides of a parallelogram are equal in length.	opp sides of $\parallel \text{ m}$
If the opposite sides of a quadrilateral are equal, then the quadrilateral is a parallelogram	opp sides of quad are $=$ OR converse opp sides of a parm
The opposite angles of a parallelogram are equal.	opp $\angle \text{ s of } \parallel \text{ m}$
If the opposite angles of a quadrilateral are equal then the quadrilateral is a parallelogram	opp $\angle \text{ s of quad are } =$ OR converse opp angles of a parm
The diagonals of a parallelogram bisect each other.	diag of $\parallel \text{ m}$
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.	pair of opp sides $=$ and $\parallel$
If one pair of opposite sides of a quadrilateral are equal and parallel, then the quadrilateral is a parallelogram.	pair of opp sides $=$ and $\parallel$
The diagonals of a parallelogram bisect its area.	diag bisect area of $\parallel \text{ m}$
The diagonals of a rhombus bisect at right angles.	diags of rhombus
The diagonals of a rhombus bisect the interior angles	diags of rhombus
All four sides of a rhombus are equal in length.	sides of rhombus
All four sides of a square are equal in length	sides of square
The diagonals of a rectangle are equal in length	diags of rect
The diagonals of a kite intersect at right-angles	diag of kite
A diagonal of a kite bisects the other diagonal	diag of kite
A diagonal of a kite bisects the opposite angles	diag of kite

INFORMATION SHEET: MATHEMATICS

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

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

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} ; r \neq 1$$

$$S_\infty = \frac{a}{1 - r} ; -1 < r < 1$$

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

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

In ΔABC :

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

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

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

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

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

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

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

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

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

$$\bar{x} = \frac{\sum x}{n}$$

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

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$