

KING DAVID HIGH SCHOOL LINKSFIELD



MATHEMATICS

GRADE 12 PRELIMINARY EXAMINATIONS

PAPER 1

AUGUST 2017

NAME: _____

Total: 150 marks

Reading Time: 10 minutes

Writing Time: 3 hours

This paper contains 7 pages (including this cover) and a data sheet.

Check that your paper is complete.

Please read the following instructions carefully:

1. Answer all questions on A4 paper.
2. Pay careful attention to time management and mark allocation.
3. Write legibly and not in pencil.
4. Calculators may be used unless otherwise instructed.
5. All necessary calculations must be clearly shown. You will **NOT** receive full credit if you write down only the answers and show no working out.

1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
[11]	[7]	[19]	[8]	[11]	[16]	[12]	[18]	[14]	[11]	[14]	[9]	[150]

MARK: %

QUESTION 1

Solve if

- a) $(3x + 2)(x + 3) \geq 0$ (3)
- b) (i) $\sqrt{10 + k} + 2 = k$ (5)
- (ii) hence solve for x if: $\sqrt{10 + 3^x} = 3^x - 2$ (3)

QUESTION 2

- a) The solution of a certain quadratic equation is given by $x = \frac{-2 \pm \sqrt{13 - 2k}}{3}$
Determine the greatest integral value of k for which the roots will be rational. (3)
- b) If a polygon has n sides, it will have $\frac{1}{2}n(n - 3)$ diagonals. Calculate the number of sides of a polygon which has 54 diagonals. (4)

QUESTION 3

- a) The seventh term of an arithmetic sequence exceeds the fourth term by 9 and the sixth term is 5.
- (i) Determine the values of the first term and the common difference. (3)
- (ii) How many terms must be added to give a sum of 1 005? (4)
- b) Determine the sum of the first 25 terms of the series
 $2 - 3 + 4 - 6 + 8 - 9 + \dots$ (6)
- c) The sequence 3; 7; 11; 15 ... forms the first differences of the terms of the quadratic sequence with 5 as the first term.
- (i) Write down the next two terms of the quadratic sequence. (2)
- (ii) Determine a formula for the general (n^{th}) term of the quadratic sequence. (4)

QUESTION 4

Consider the infinite geometric series $(x - 2)^2 + (x - 2)^3 + (x - 2)^4 + \dots$

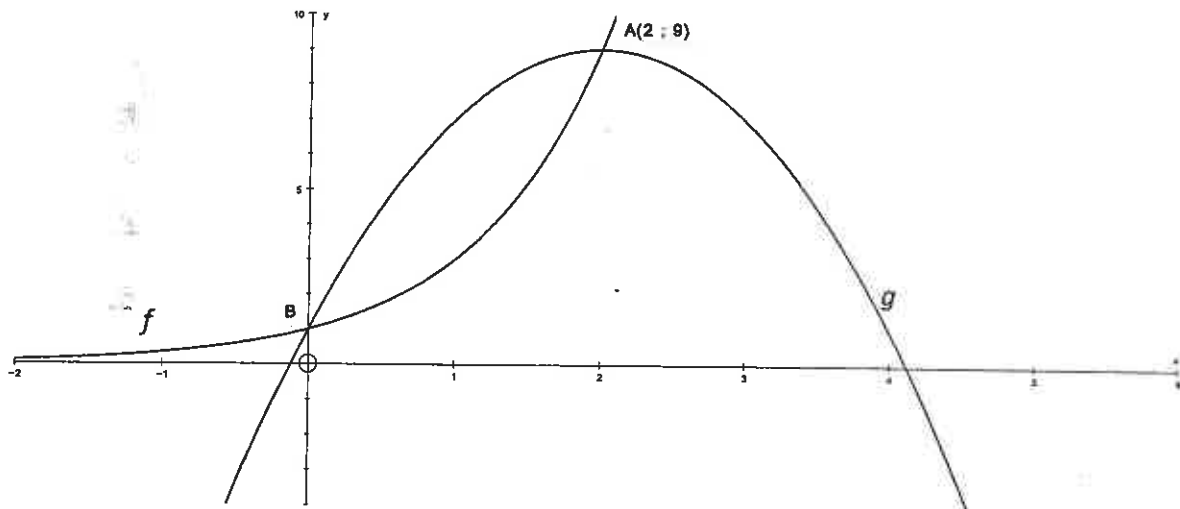
- a) Write down the common ratio, r, in terms of x. (1)
- b) For which value(s) of x will the series converge? (3)
- c) If $S_{\infty} = 4$ determine the value(s) of x in simplest surd form. (4)

QUESTION 5

Jacob buys a property for R2 000 000. He puts down a 20% deposit and borrows the balance from **GEE UPTA** bank at a fixed rate of 9% pa compounded monthly.

- a) (i) What is the monthly repayment he needs to make if he wishes to repay the loan over 20 years? (3)
- (ii) How much INTEREST will he pay in total over the 20 year period? (2)
- (iii) What is the balance owing after he has made 150 payments? (3)
- b) After how many years will a car's value decrease from R100 000 to R15 000 if it depreciates at 7% compounded annually? (3)

QUESTION 6



The graphs of $f(x) = p^x$ and $g(x) = ax^2 + bx + c$ intersect at B and A(2 ; 9) which is the turning point of the parabola.

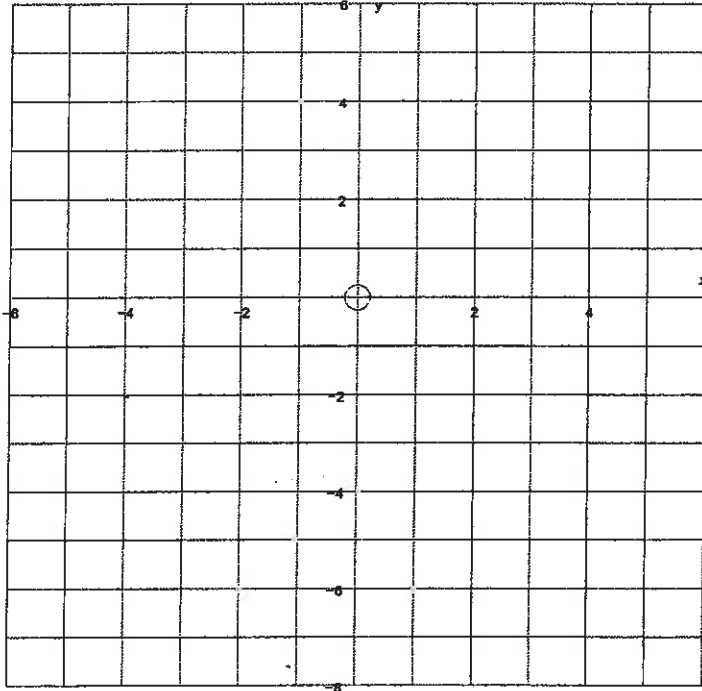
- a) Determine the value of p. (2)
- b) Determine the values of a; b and c. (4)
- c) (i) Determine the equation of $f^{-1}(x)$ (2)
- (ii) For which value(s) of x is $f^{-1}(x) < 0$? (2)
- d) Write down
- (i) the equation of the asymptote of $y = f(x) - 3$ (2)
- (ii) the co-ordinates of the x and y intercepts of $y = f(x) - 3$ (4)

QUESTION 7

Given

$$y + 2 = \frac{4}{x + 1}$$

- a) Sketch the above graph on the axes below. Clearly indicate the intercepts with the axes and all asymptotes on the graph. (6)

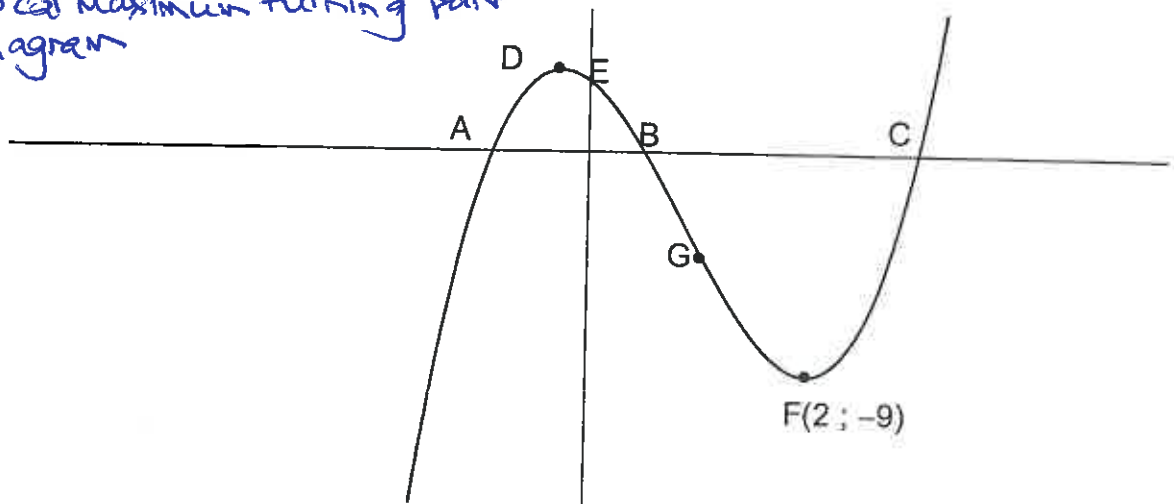


- b) Write down the equation of the axis of symmetry in the form $y = mx + c$ if $m < 0$. (3)
- c) Determine the equation of the inverse of the given graph. (3)

QUESTION 8

- a) Determine from first principles $f'(x)$ if $f(x) = 2x^2 + x$. (4)
- b) Determine $\frac{dy}{dx}$ if $y = \frac{\sqrt{x} + 2}{3x}$ (4)
- c) $f(x) = x^3 + ax^2 + bx + c$ has a non – horizontal point of inflection at the point (2; 12)
- (i) Show that $a = -6$ (5)
- (ii) The gradient of $f(x)$ at the point (2 ; 12) is -3 . Determine the values of b and c . (5)

QUESTION 9 The diagram is not drawn to scale.
D is local maximum turning point on this diagram



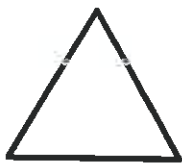
The figure represents the graph of $y = 2x^3 - 5x^2 - 4x + 3$, which has a local minimum at $F(2; -9)$.

- If A is the point $(-1; 0)$, calculate the co-ordinates of B and C, the other intercepts with the x-axis. (4)
- Determine the x co-ordinate of D, the local maximum turning point. (3)
- For which values of x is the graph concave up? (3)
- If G is the point of inflection of the function, determine the length of GA. (4)

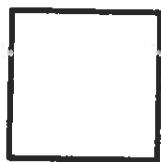
QUESTION 10

a) Determine $\lim_{x \rightarrow 3} \frac{x^3 - 9x}{x - 3}$ (3)

b) The sketches below show regular polygons with k sides for different values of k:



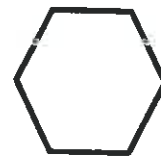
$k = 3$



$k = 4$



$k = 5$

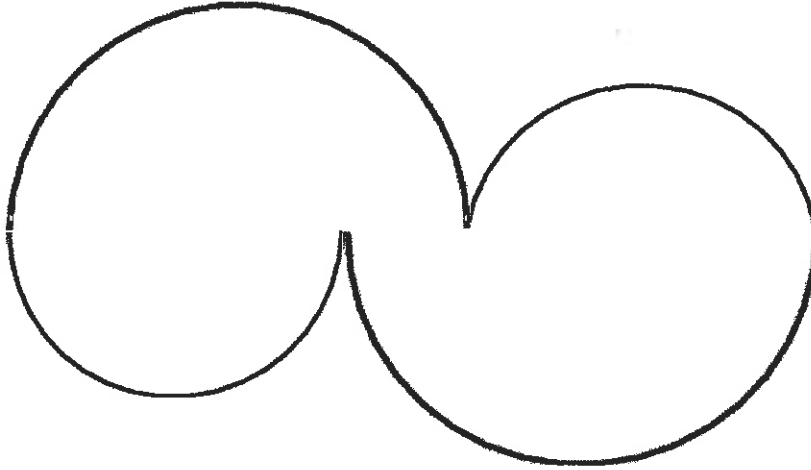


$k = 6$

What can be deduced about the shape of the polygon as $k \rightarrow \infty$? (2)

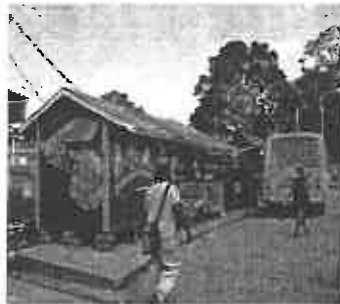
- c) The figure consists of 4 semi – circles, the bigger two with a radius of R and the smaller two with a radius of r.

The values of R and r may vary, but the sum $R + r$ remains a constant 200mm. Determine the values of R and r so that the area of the figure is a minimum. (6)



Question 11

- a) The digits 1 to 7 are used to make 4 – digit codes. What is the probability of getting an **even code less than 4000** if digits may not be repeated? (4)
- b) Elijah’s Spaza Shop has 5 strawberry yogurts; 4 peach yogurts, 4 chocolate yogurts and 3 banana yogurts.
- (i) In how many different ways can these yogurts be arranged in the display fridge? (2)
- (ii) What is the probability that all the banana yogurts are next to each other in the fridge? (3)



- c) The events A and B are such that $P(A \cup B) = 0,75$ and $P(A) = 0,3$. Determine $P(B)$ if
- (i) A and B are mutually exclusive events. (2)
- (ii) A and B are independent events. (3)

Question 12

The functions $f(x) = 2x^2 + 3px - 3$ and $g(x) = 2x^2 + (p - 2)x - 1$ have a common factor of $(x - r)$.

a) Prove that $r = \frac{1}{p+1}$ (5)

b) Hence, or otherwise determine the numerical value of p . (4)

