

SESSION 14: CONSOLIDATION: FUNCTIONS & ALGEBRA

Key Concepts

In this session we will focus on summarising what you need to know about:

- Revision of Functions
- Revision of Transformations
- Revision of Financial Maths

X-ample Questions

Question 1

Given: $f(x) = \frac{2}{x+1}$

- (a) Write down the equations of the asymptotes. (2)
- (b) Sketch the graph of f indicating the coordinates of the y -intercept as well as the asymptotes. (4)
- (c) Write down the equation of the graph formed if the graph of f is shifted 3 units right and 2 units upwards. (2)
- (d) Determine graphically the values of x for which $\frac{2}{x+1} \geq 1$ (4)

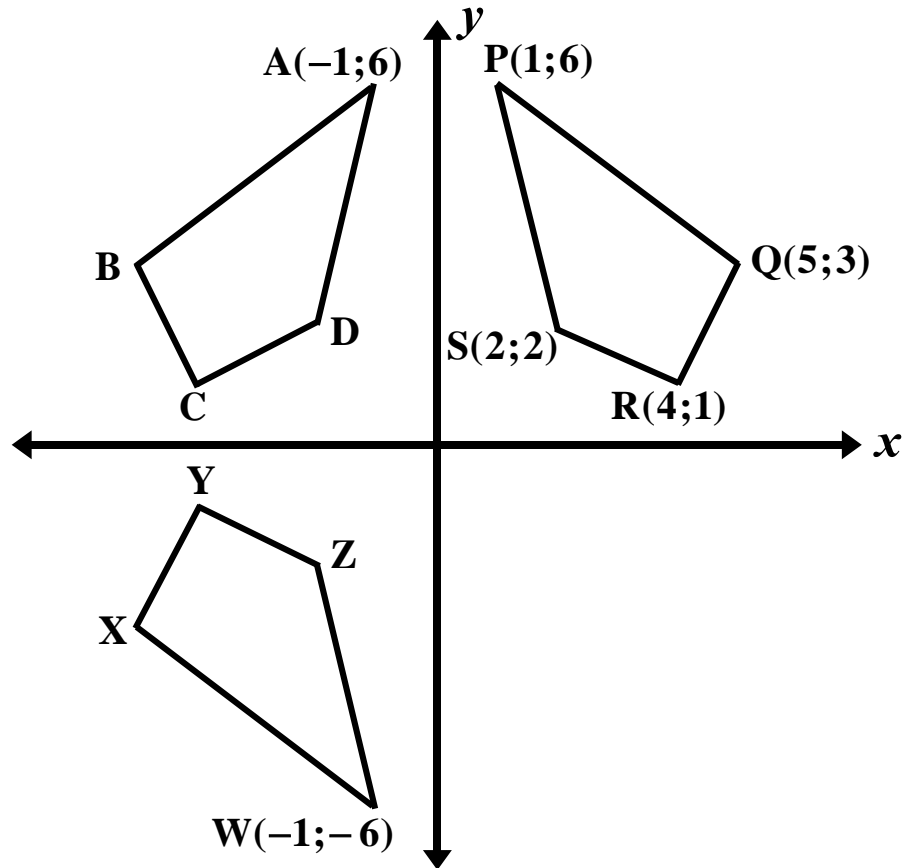
Question 2

Given: $f(x) = 2(x-1)^2 - 8$ and $h(x) = 4^x$

- (a) Sketch the graphs of h and f on the diagram sheet provided. Indicate ALL intercepts with the axes and any turning points. (9)
- (b) The graph of f is shifted 2 units to the LEFT. Write down the equation of the new graph. (1)
- (c) Show, algebraically, that $h\left(x + \frac{1}{2}\right) = 2h(x)$. (3)

Question 3

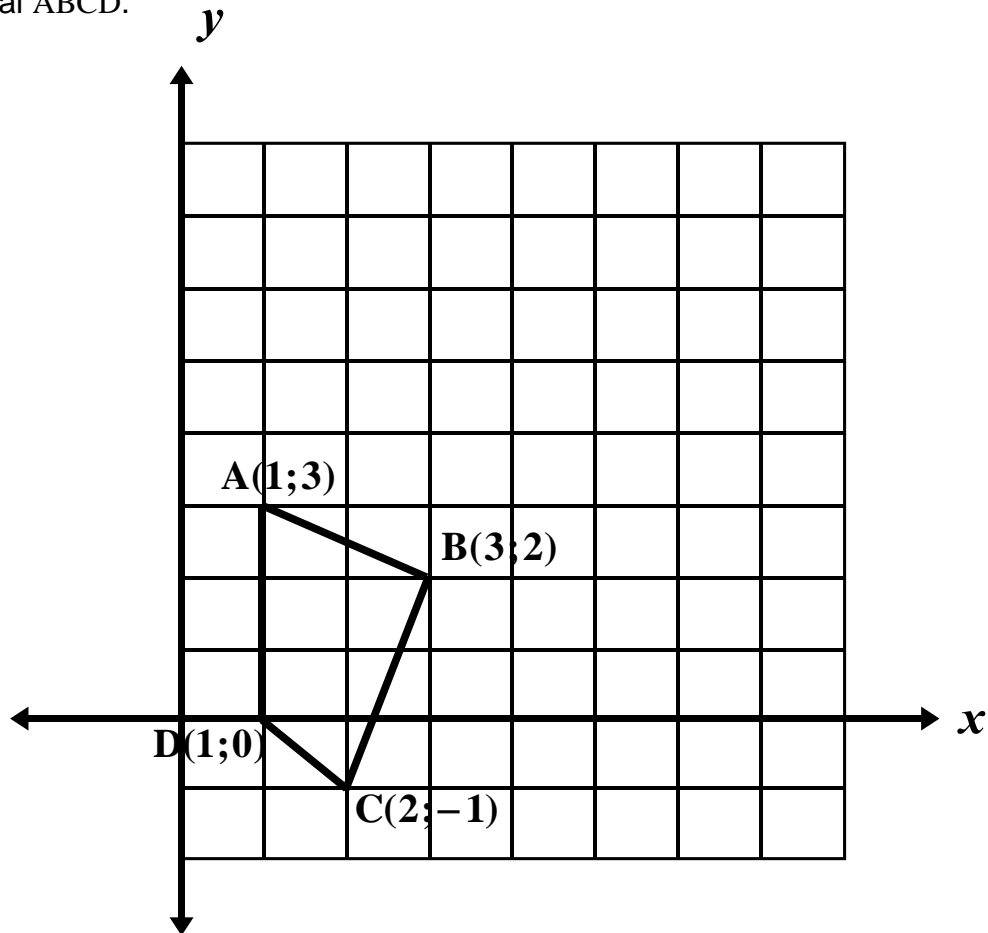
The diagram below shows quadrilateral PQRS and its transformations ABCD and WXYZ.



- State the general rule for the coordinates of any point representing the transformation of quadrilateral PQRS to quadrilateral ABCD. (2)
- Describe TWO possible transformations of quadrilateral PQRS to quadrilateral WXYZ. (6)
- Write down the coordinates of the reflection of point D in the line $y = x$. (2)

Question 4

$A(1; 3)$; $B(3; 2)$; $C(2; -1)$ and $D(1; 0)$ are the coordinates of the vertices of quadrilateral ABCD.



- (a) ABCD has to be enlarged through the origin by a factor of 2 units.
- (i) Draw this enlargement on the diagram above and indicate the vertices $A'B'C'D'$. (5)
 - (ii) Write down the coordinates of A' and C' . (2)
 - (iii) If the area of ABCD is x square units, determine the area of $A'B'C'D'$. (2)
- (b) ABCD is rotated 90° clockwise about the origin.
- (i) State the general algebraic rule. (2)
 - (ii) Write down the coordinates of the image $A'B'C'D'$. (4)

Question 5

Aaron invests R140 000 for six years at 14% per annum compounded half-yearly.

- (a) Calculate the future value of the investment using the nominal rate. (4)
- (b) Convert the nominal rate of 14% per annum compounded half-yearly to the equivalent effective rate (annual). (4)
- (c) Now use the annual effective rate to show that the same accumulated amount will be obtained as when using the nominal rate. (4)

Question 6

- (a) Judith deposits R80000 into a savings account. The interest rate for the first four years is 8% per annum compounded monthly. Thereafter, the interest rate changes to 9% per annum compounded quarterly. Calculate the value of the investment at the end of the tenth year. (7)
- (b) Julius wants to have saved R200 000 in eight years time. How much must he invest now if the interest rate for the first six years will be 6% per annum compounded monthly and 8% per annum compounded quarterly for the remaining two years? (7)

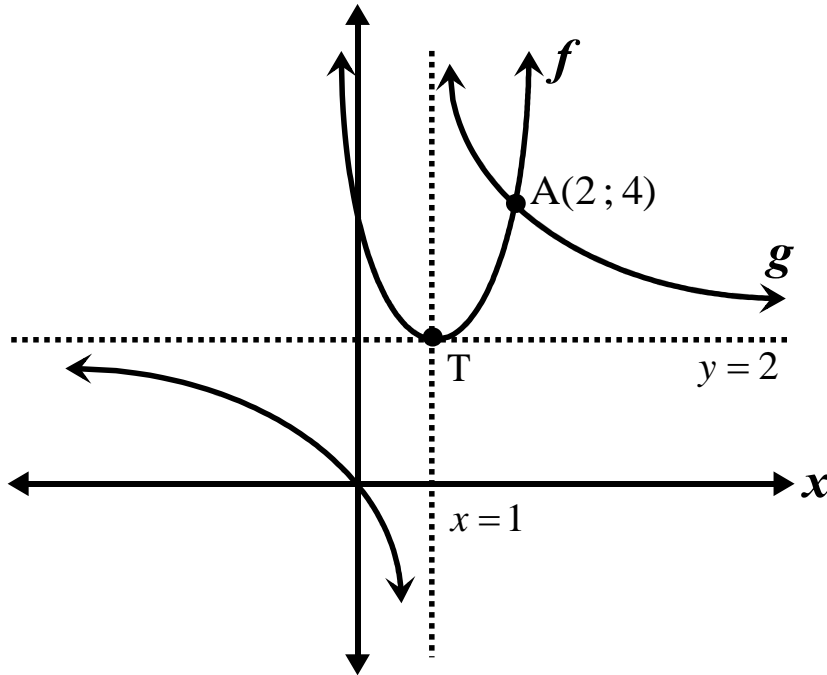
X-ercises

Question 1

In the diagram, the graphs of the following functions have been sketched:

$$f(x) = a(x+p)^2 + q \quad \text{and} \quad g(x) = \frac{a}{x+p} + q$$

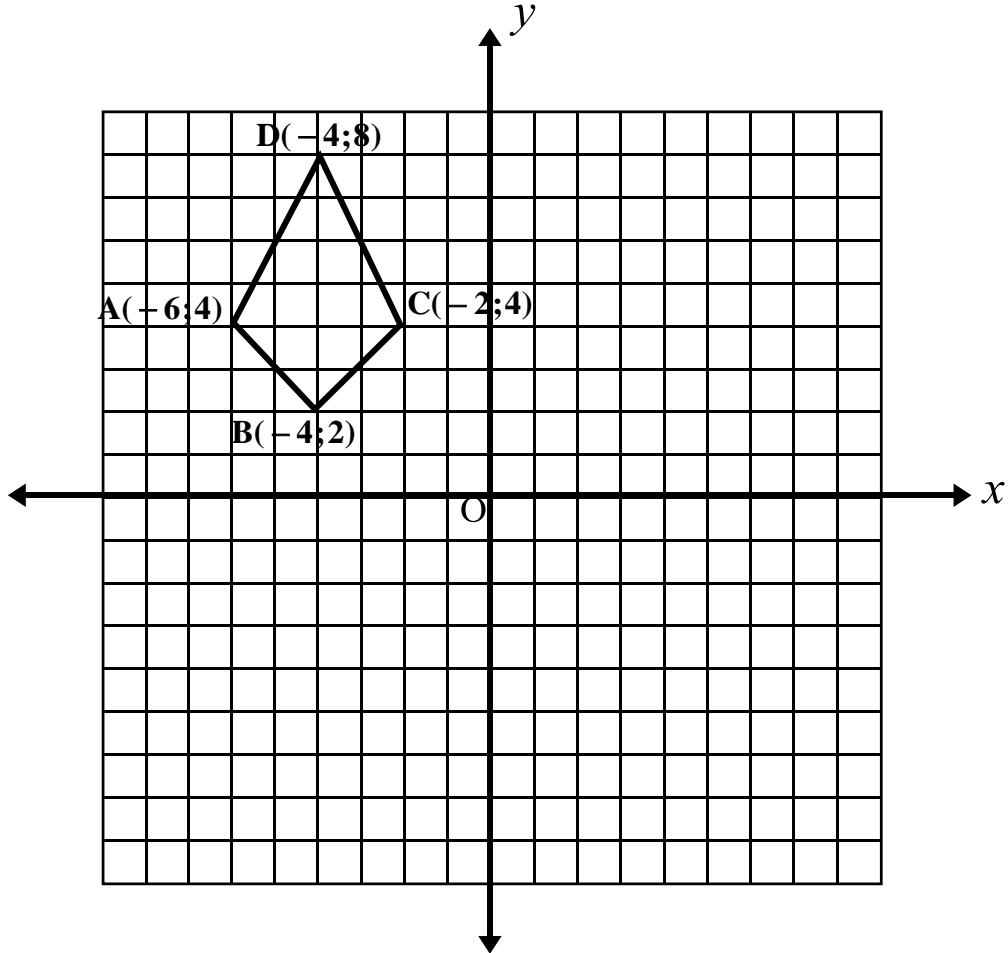
The two graphs intersect at $A(2; 4)$ and the turning point of the parabola lies at the point of intersection of the asymptotes of the hyperbola. The line $x = 1$ is the axis of symmetry of the parabola.



- Determine the equation of $f(x)$ in the form $y = a(x+p)^2 + q$ (3)
- Determine the equation of $g(x)$ in the form $y = \frac{a}{x+p} + q$ (3)
- Write down the range for the graph of f . (1)
- If the graph of f is shifted 1 unit left and 2 units downwards, write down the equation of the new graph formed. (2)
- Write down the values of x for which $g(x) \leq 0$ (2)

Question 2

In the diagram below, kite ABCD has been drawn with the coordinates of the vertices indicated.



- (a) On the diagram above, draw the image $A'B'C'D'$ if ABCD is rotated 90° anti-clockwise. Indicate the coordinates of B' and C' (4)
- (b) State the general coordinates in terms of x and y of this rotation of 90° anti-clockwise using the notation $(x; y) \rightarrow$ (2)
- (c) Now draw the image $A''B''C''D''$ if ABCD is transformed under the rule $(x; y) \rightarrow \left(\frac{1}{2}x; \frac{1}{2}y\right)$. (2)
- (d) Write down the value of the following ratio: (2)
- $$\frac{\text{Area ABCD}}{\text{Area } A''B''C''D''}$$

- (e) Draw image $A'''B'''C'''D'''$ if $A'B'C'D'$ is rotated 180° clockwise. Indicate the coordinates of A''' (3)
- (f) Draw the image EFGH if $A'B'C'D'$ is transformed under the rule $(x; y) \rightarrow (-x; y)$. Indicate the coordinates of E. (3)
- (g) Write down the single algebraic rule if ABCD is reflected about the x -axis, followed by a translation of 7 units right, followed by an enlargement by a scale factor of 2 units. (4)

Question 3

- (a) Patricia deposited a certain amount of money into a bank account paying 8% per annum compounded half-yearly. After four years, the money has a value of R100 000.
- (i) Convert the nominal interest rate into the equivalent annual effective rate. (2)
- (ii) Calculate the amount of money originally deposited into the bank account by Patricia. (2)
- (b) A motor car bought for R130 000 depreciates on a reducing balance at a rate of 15% per annum for a period of three years. Thereafter, it continues to depreciate on a reducing balance at a rate of 16% per annum for a further two years.
- (i) Calculate the depreciated value of the motor car at the end of the five year period. (4)
- (ii) What single annual rate of depreciation (reducing balance) will yield the same depreciated value over the five year period? Round off your answer to one decimal place. (3)

Question 4

- (a) Maria decided to start saving money for her son's future education. She immediately deposited R4000 into a savings account. Three years later, she deposited a further R5000 into the account. One year later, she withdrew R2000 in order to do repairs around the house. Her son needed the money four years after her withdrawal of R2000. The interest rate for the first three years was 15% per annum compound monthly. The interest rate for the remaining five years was 16% per annum compounded quarterly. Calculate the future value of his money at the end of the savings period which lasted eight years. (8)

- (b) Thabo borrowed money in order to finance the purchase of new home. He paid a deposit of R100 000. He then repaid the balance that he owed by means of a payment of R160 000 after three years. His last payment of R170 000 was paid four years after the previous payment. The interest rate for the first three years was 12% per annum compounded monthly. The interest rate was then 14% per annum compounded half-yearly for the remaining four years. What was the original price of the home?