



Name: _____ Date : _____

IM 3 UNIT 4 TEST V3 – Polynomial & Rational Functions
 Teacher: Mr. Santowski and Ms. Aschenbrenner

Score: _____

PART 1 - CALCULATOR ACTIVE QUESTIONS

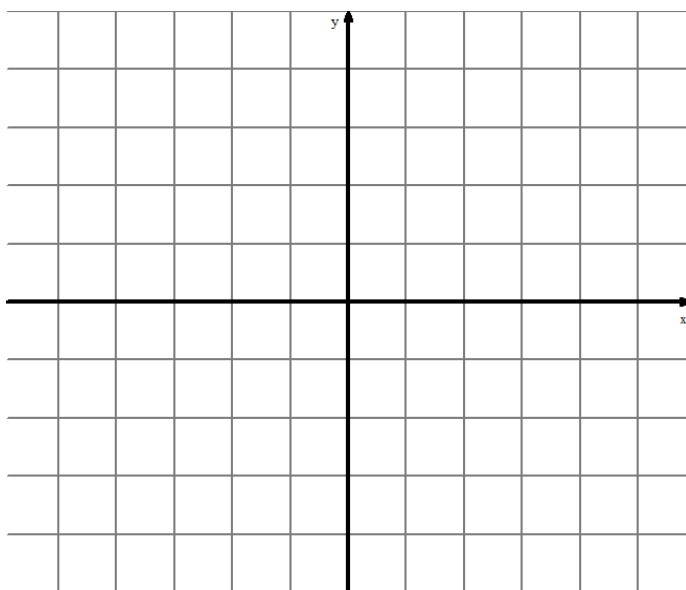
Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided the answer is supported by working. Solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer

1. Given the rational function $f(x) = \frac{4x + 3}{2x + 1}$:

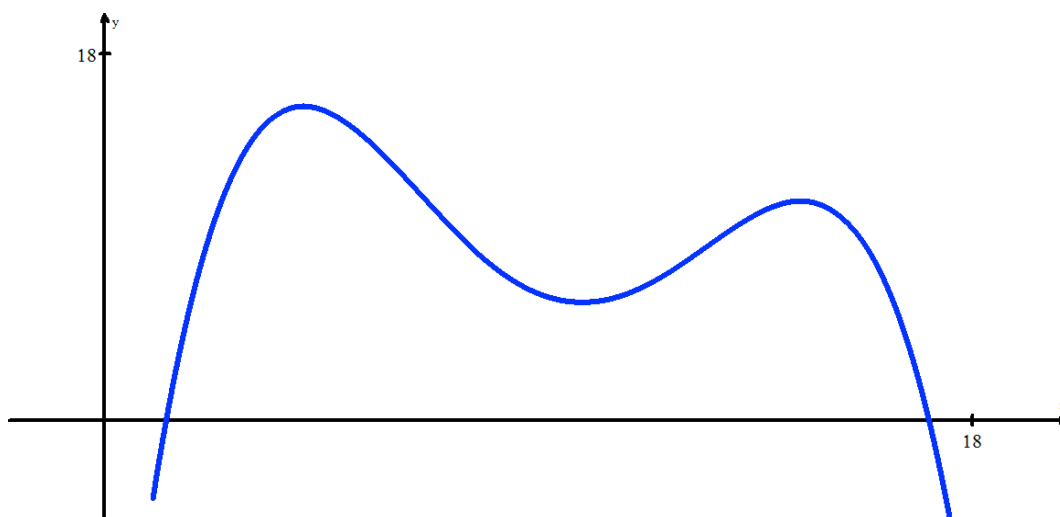
- a. Determine the equation of the horizontal and vertical asymptotes.
- b. State the domain and range of the function.
- c. Determine the x- and y-intercepts.
- d. Sketch this function, paying attention to the answers to the previous questions (and thus **labeling**).

e. Evaluate $f(3)$.

f. Solve $\frac{1}{2} = f(x)$.

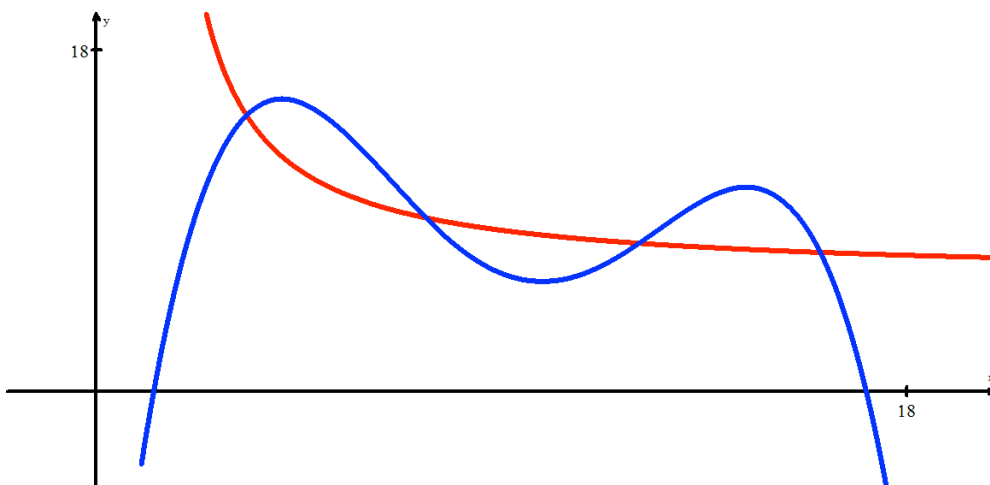


2. This year's Junior class council has been attempting to raise funds for Senior Prom for the past two years by selling T shirts. The sales of T shirts per month is modeled using the polynomial equation $S(m) = -\frac{1}{100}(m^4 - 38m^3 + 488m^2 - 2368m + 2300)$, where S is the monthly sales in hundreds of EGP and m is the number of months since January of 2015 (so for example, let $m = 0$ is Jan 1, 2015 and thus $m = 1$ is Feb 1, 2015 and $m = 2.5$ is mid March of 2015 etc..)
- a. When did the **absolute** maximum sales occur? What was the sales amount at this time?
- b. The graph shows the beginning and end of this fund raiser at the x-intercepts. Determine these x-intercepts and thus state the domain of this function (given this context)
- c. During which times of this fund raising activity where the sales **decreasing**?

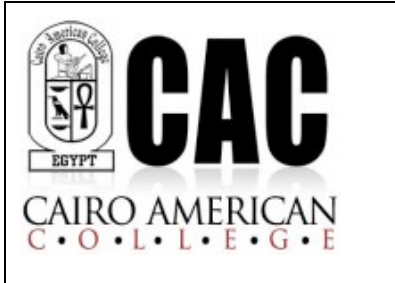


QUESTION 2 CONTINUED: During this fund raising activity, they also had many expenses. The monthly expenses are modeled using the rational function $C(m) = \frac{5m + 15}{m - 1}$, where C is the monthly costs in hundreds of EGP and m is the number of months since Jan of 2015.

- d. What expenses would there be for this type of fund raising activity? State two ideas.
- e. The monthly expenses are modeled by a decreasing rational function with a horizontal asymptote at $C = 500$. Suggest one reason as to why that might be.
- f. Recall that the PROFITS of a business are determined by the difference between its SALES and its COSTS. Determine in which months the PROFITS of this fund raiser were negative?
- g. OPINION Question: Given the graphs of the Sales and Costs, do you believe that the fund raiser was a successful event for the Junior Class Council?



3. A cubic function has a zero at $x = -1$ and a zero at $x = 3$ which has a multiplicity of 2 and its y-intercept is at $(0,18)$.
- Determine the equation of this cubic function in factored form.
 - Convert the equation into standard form.
 - Provide a sketch of this cubic.



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PART 2 - CALCULATOR INACTIVE QUESTIONS

Show all work and write all answers in the spaces provided. Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided the answer is supported by written work.

1. Answer the following questions that each deal with basic concepts from our unit.

a. Show whether or not $2x + 1$ is a factor of
 $p(x) = 2x^4 + x^3 - 2x^2 + 5x + 3$

b. State the end behaviours of $f(x) = \frac{2x - 5}{4x - 8}$

c. Determine the quotient when
 $x^4 - 7x^2 + 4x - 3$ is divided by $x + 3$

d. Determine the leading coefficient of
 $y = -3(4 - x)(2x - 3)^2$

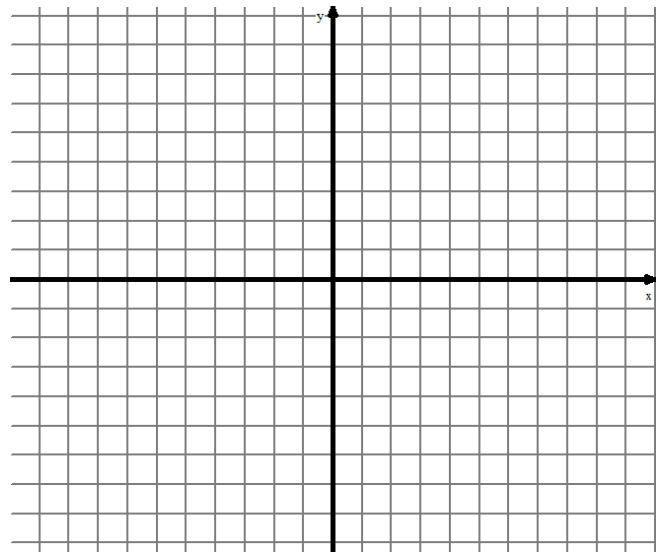
2. Given the rational function $r(x) = \frac{3}{x+4} - 5$, answer the following analysis questions:

- a. State the equations of the asymptotes of $r(x)$. b. State the domain and range of $r(x)$.

The parent function, $y = \frac{1}{x}$, had two key points, one at (1,1) and the other at (-1,-1).

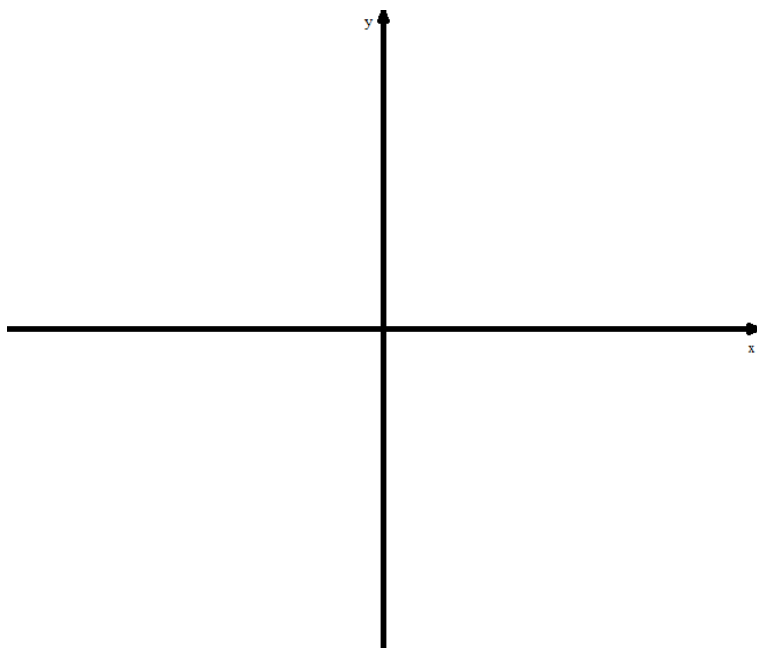
- c. List the transformations that have been applied to the parent function $y = \frac{1}{x}$. d. Determine where these two key points are now located, given the transformations that have been applied.

e. On the grid included, sketch the function $r(x) = \frac{3}{x+4} - 5$. On your sketch, label the asymptotes and the new key points.



3. The cubic polynomial equation $g(x) = 2x^3 + x^2 - 13x + 6$ is presented in standard form.
- a. You are required to factor it using synthetic division and then write the equation now in factored form.

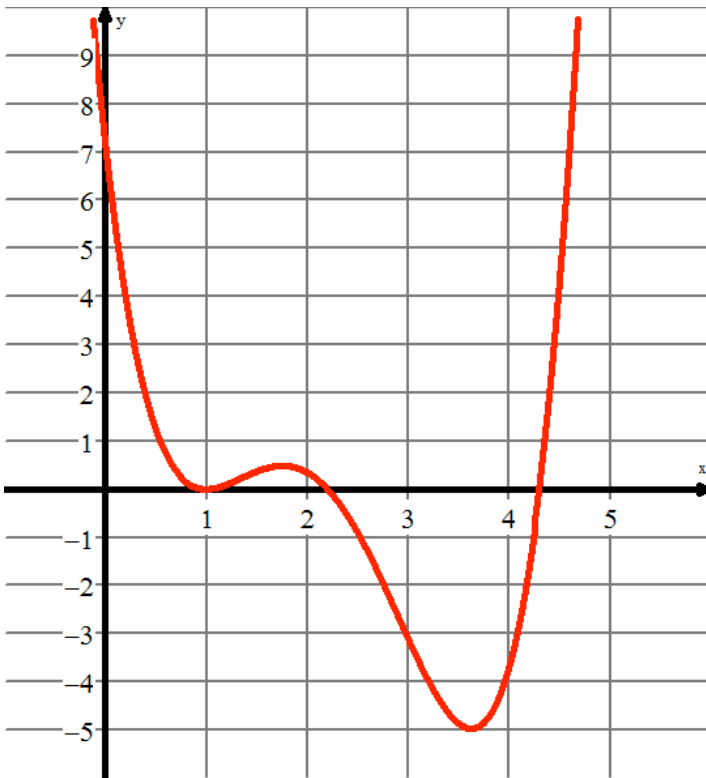
- b. Now that the equation has been factored, present a sketch of the cubic function. Label the zeroes.



4. You are given a graph of the polynomial function below. Use the graph to **estimate** and thus answer the following:

a. What are the linear factors of this polynomial?

b. Predict the remainder when the polynomial is divided by $x - 4$. Explain how you determined your answer.



BONUS: When the polynomial $x^3 + x^2 + k^3x - 6$ when divided by $x - 3$, the remainder was 6. Solve for k