

PART A - CALCULATOR ACTIVE: Show all necessary set-up for the calculator portion. Write a therefore statement to fully answer any word problems. Round any numbers to 3 decimal places.

1. Who am I? Write the word in the blank for the feature of the graph of a rational function for each description.

a) I am an  $x$  - value that makes the  $y$  - value undefined: \_\_\_\_\_

b) I am an  $x$  - value that makes the  $y$  - value zero. \_\_\_\_\_

c) I am an  $x$  - value that makes the  $y$  - value indeterminate. \_\_\_\_\_

2. The function  $g(x) = \frac{3x+5}{x+2}$  is given.

a) Rewrite  $g(x)$  in proper fraction form:

b) What is the quotient term and what is its significance to the graph of  $g(x)$ ?

c) What is the remainder over denominator term and what is its significance?

3. Determine (a) the coordinates of the hole(s) of  $f(x) = \frac{13x - x^3 - 12}{-2x^4 - 9x^3 + 21x^2 + 88x - 48}$  and (b) the equation of the simplified function to which  $f(x)$  is equivalent.

4. Some fireworks are launched at the Asian Games opening ceremonies with an initial velocity of 30 m/s upward from a starting height of 35 m.
- Write the functions of height  $y(t)$  and velocity  $v(t)$  of the fireworks.
  - How high are the fireworks at 2 seconds?
  - What is the velocity of the projectile at 2 seconds?
  - When do the fireworks reach maximum height?
  - What is the maximum height of the fireworks?
  - What is the total time that the fireworks are in the air?
  - With what velocity do the fireworks hit the ground (just *before* the collision with the ground stops the motion of the fireworks)?

5. The Welcome Home Apartment rental company has 1600 apartments, of which 800 are currently rented at \$300 per month. A market survey indicates that a \$5 decrease in monthly rent will result in 20 new rental contracts.

a) Determine a function  $R(x)$  that models the total rental income made by Welcome Home in one month, where  $x$  is the number of \$5 decreases in monthly rent. Justify your model.

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b) What is the maximum income earned by Welcome Home in one month? For how many rented apartments does this occur? How much is the rent for one apartment when the maximum revenue occurs?

c) State the values of the graphing window that allow you to view Welcome Home's maximum monthly income:

xmin =

xmax =

xsc1 =

ymin =

ymax =

yscl =

PART B - Calculator Inactive: Answer all questions in the space provided. Show all work.

6. Rewrite  $g(x) = \frac{3x+5}{x+2}$  in transformational form. (Hint: See the Calculator Active portion.)

a) State the transformations on  $y = \frac{1}{x}$ :

b) State the domain and range of  $g(x)$ . Domain: \_\_\_\_\_ Range: \_\_\_\_\_

c) State the value of  $\lim_{x \rightarrow -2} g(x)$  and indicate its relevance to  $g(x)$ . (Bonus: State the values of  $\lim_{x \rightarrow -2^-} g(x)$  and  $\lim_{x \rightarrow -2^+} g(x)$ .)

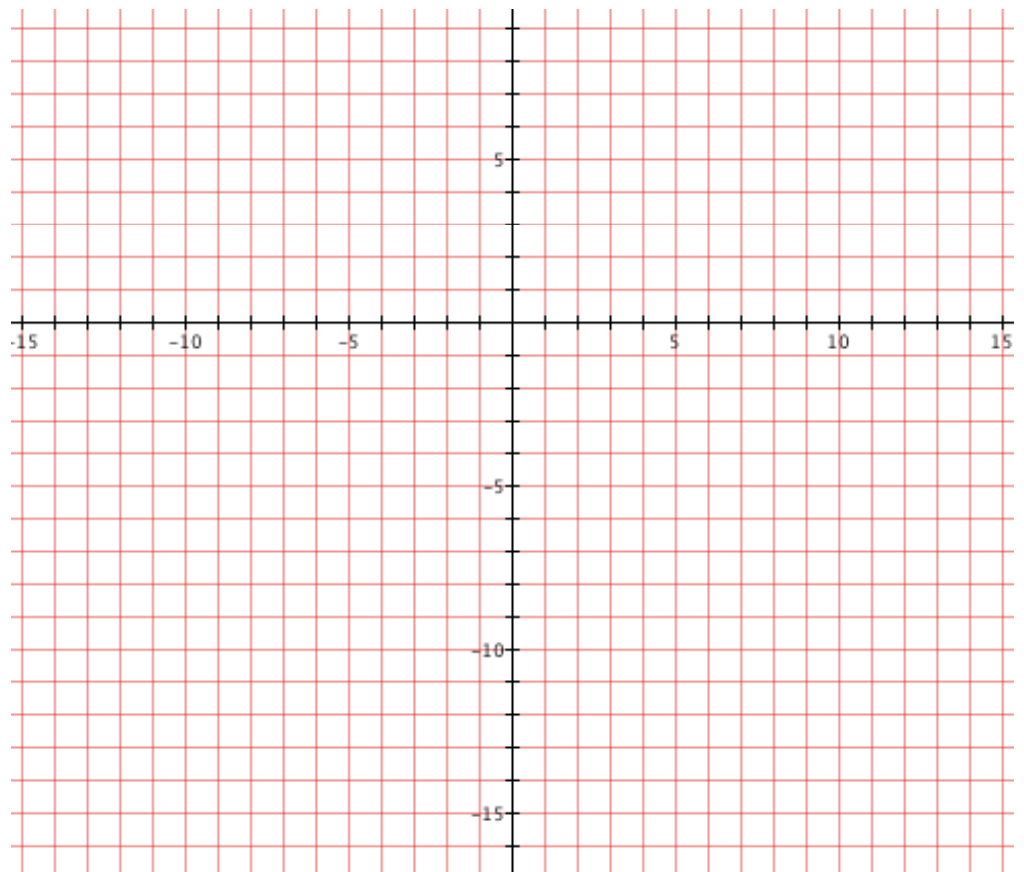
d) State the value of  $\lim_{x \rightarrow \pm\infty} g(x)$  and indicate its relevance to  $g(x)$ .

7. Sketch  $y = -(x+1)^2(x-1)^3(2x-3)$  with all relevant information.

a) What is the degree of this polynomial? \_\_\_\_\_

b) What is the end behaviour monomial for this polynomial? \_\_\_\_\_

8. Graph the rational function  $r(x) = \frac{-x^3 + x^2 + 2x}{x^2 - 4x + 3} = -x - 3 - \frac{7x - 9}{x^2 - 4x + 3}$ . Plot and label the coordinates of any holes and all intercepts, and state the equations/types of all asymptotes. Determine if/where  $r(x)$  crosses its non-vertical asymptote.



9. Match each equation with a graph by writing the equation's CAPITAL LETTER in the space below each graph, and give one reason for choosing to match that equation to the graph.

EQUATIONS

(A)  $y = \frac{1}{5} \sqrt[4]{x}$

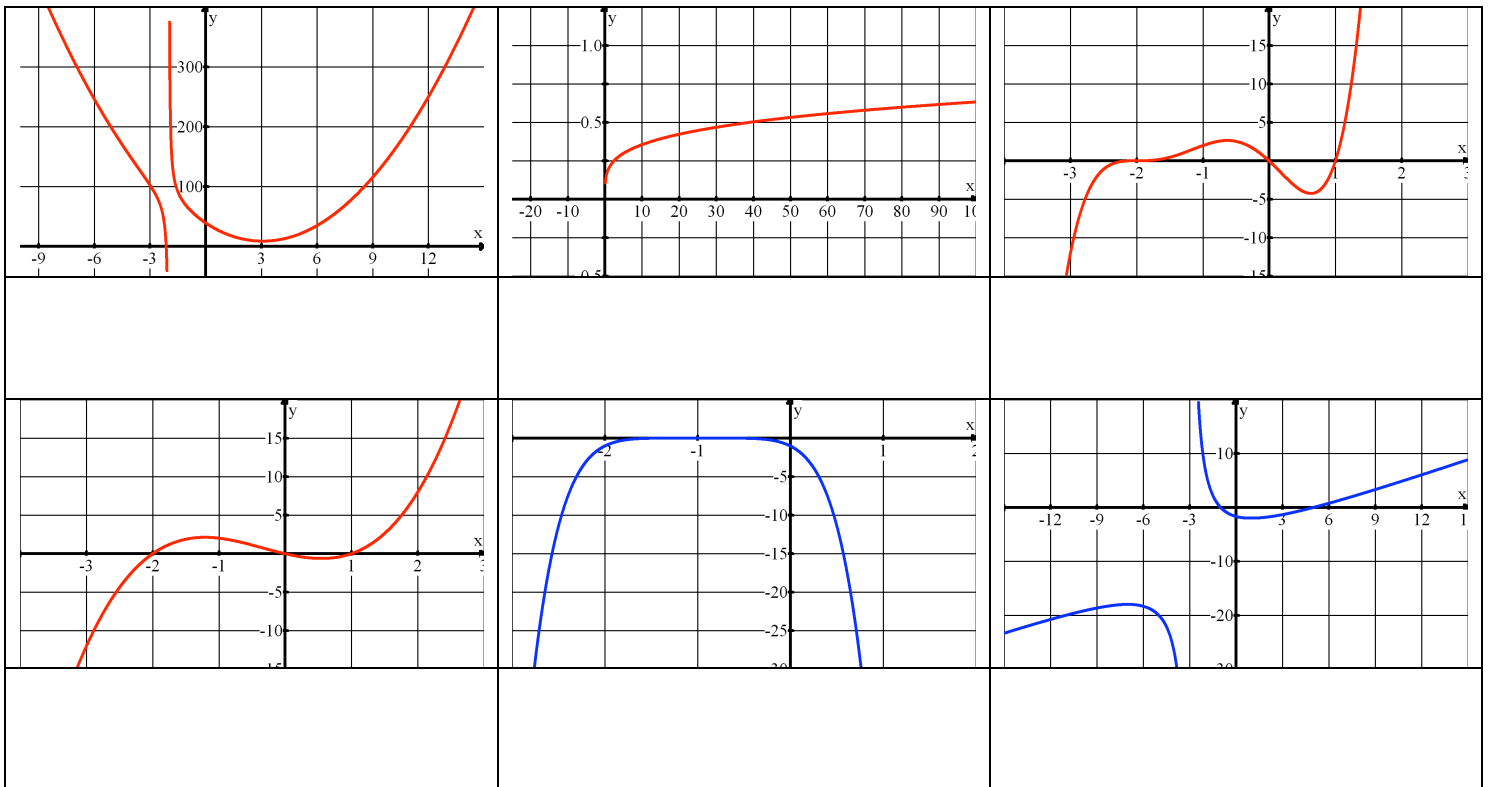
(C)  $y = x(x+2)(x-1)$

(E)  $y = x(x+2)^3(x-1)$

(B)  $y = \frac{x^2 - 4x - 5}{x + 3}$

(D)  $y = -(x+1)^6$

(F)  $y = 3x^2 - 18x + 33 + \frac{12}{x+2}$



BONUS: Determine the value(s) of  $k$  such that the line  $y = 3x - 1$  does not intersect the parabola  $y = x^2 + kx + 1$ .