BECA / IB Math 03-Quadratic functions   Name:
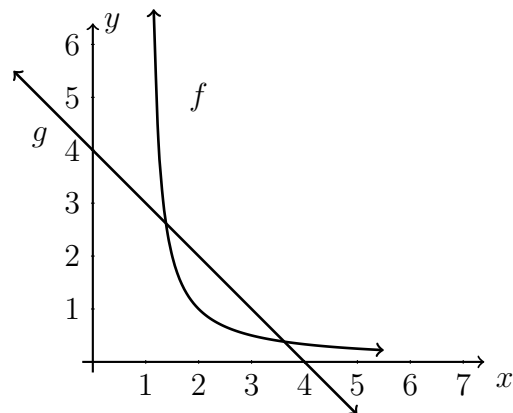7 February 2022

4.8 Classwork: Direct and inverse variation

1. The inverse function $f(x) = \dfrac{1}{x-1}$, defined for $x > 1$, and the linear function
   $g(x) = -x + 4$ are graphed below.

   (a) Find the solutions to $f(x) = g(x)$.

   (b) Write down the equation of the vertical asymptote to f.

2. The total tuition charged by a college undergraduate program is proportional to the number of full-time semesters attended. (values are for Lehman College, ignoring aid.)

   (a) Write down an equation to model the cost, using the variable C as the total tuition cost and s for the number of semesters.

   (b) Explain what the proportionality constant, k, means in this context.

   (c) If a student pays total tuition of $27,720 over four years of full-time study, find the cost of a single semester.

   (d) A student takes an extra three semesters. Find the additional tuition cost.

3. Two friends share an apartment convenient to Lehman, each paying $1,500 per month.

   (a) Model the apartment cost as an inverse variation, with r as each individual's monthly rent share and f for the number of friends in the apartment.

   (b) Explain what the proportionality constant, k, means in this context.

   (c) If they add a third roommate, how much would that lower the monthly rent for the first two friends?

4. A rational function of the form $f(x) = \dfrac{1}{x+p} + q$ is shown on the grid below.
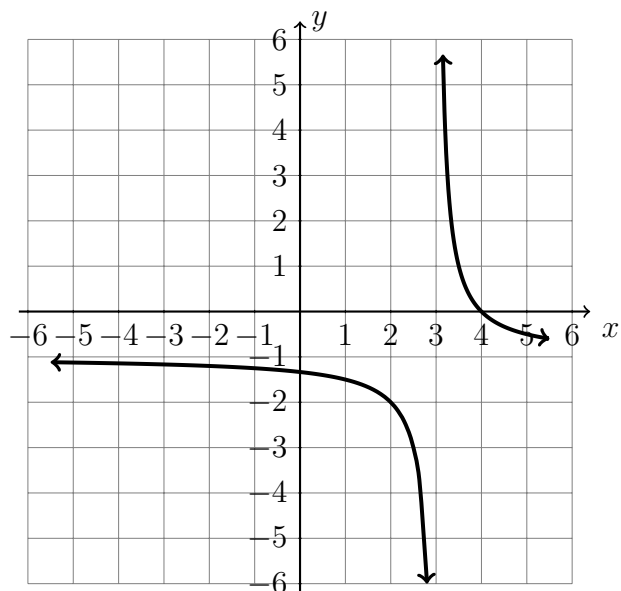
(a) Write down the equation of the horizontal asymptote.

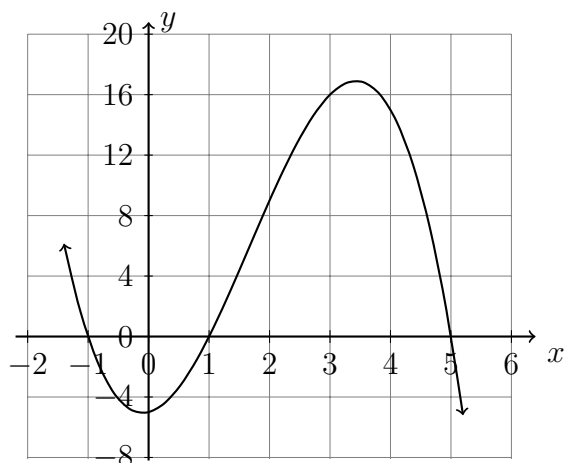(b) Write down the equation of the vertical asymptote.

(c) Hence, write down p and q.

(d) Find $f(0)$.

(e) Solve for x such that $f(x) = 0$.

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5. A cardboard box manufacturing company is building boxes with length represented by $x + 1$, width by $5 - x$, and height by $x - 1$. The volume of the box is modeled by the function below.

(a) Over what interval of positive x values is the volume positive?

(b) Estimate the maximum possible volume of the box.

(c) Approximately the value of x would maximize the volume of the box.

6. Shown in the plot below is the function $f(x) = x^3 + 4x^2 - 1x - 4$.

(a) Write down the value of $f(0)$. On the graph, mark the point for $f(0)$ with a star.

(b) Write down the solutions to $f(x) = 0$. Mark them with "X" marks on the graph.

(c) Mark the portion of the function that is *decreasing* with a squiggly line.