EXERCISES ON ASYMPTOTES AND TRANSFORMATIONS OF HYPERBOLAE

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EXERCISE 1

1. Please sketch the rectangular hyperbola $y = \frac{1}{x}$, by finding and labelling the following:

   A. The hyperbola's vertical asymptote

   i.e. the value for y at which $y = \frac{1}{x}$ would be undefined.
   Hint: $y =$ a fraction with a numerator of 1.
   What value would this fraction never be equal to?

   B. The hyperbola's horizontal asymptote

   i.e. the value for x at which $y = \frac{1}{x}$ would be undefined.
   Hint: x is the denominator of a fraction.
   What value can the denominator of a fraction never be equal to?

   C. <u>Challenge</u>
   The coordinates of the two points on $y = \frac{1}{x}$ where $y = x$

   Hint: How would you algebraically determine where the functions $y = \frac{1}{x}$ and $y = x$ intersect?

EXERCISE 2

1. Please sketch the rectangular hyperbola $y = \frac{3}{x}$, and:

   A. Find and label the hyperbola's vertical asymptote
   B. Find and label the hyperbola's horizontal asymptote
   C. Find and label the coordinates of the two points on $y = \frac{3}{x}$ where $y = x$
   D. State what transformation has been applied to $y = \frac{1}{x}$ to produce $y = \frac{3}{x}$

2. Please sketch the rectangular hyperbola $y = 2 - \frac{7}{x}$, and:

   A. Find and label the hyperbola's vertical asymptote
   B. Find and label the hyperbola's horizontal asymptote
   C. Find and label the point (x, y) which is the centre of the rectangular hyperbola

      Hint: The centre of a rectangular hyperbola is located at the point (x, y) at which the horizontal and vertical asymptotes of the hyperbola intersect.

   D. Find and label the coordinates of the two points on $y = 2 - \frac{7}{x}$ where $y = -x + 2$

   E. <u>Challenge</u>
      In Exercise 1.1C and Exercise 2.1C, you were asked to find the coordinates of the two points on the hyperbola where $y = x$. However, in Exercise 2.2D, you were asked to find the coordinates of the two points on the hyperbola where $y = -x + 2$ instead – why might this be? What are these points in the context of the shape of the hyperbola, and why does finding them allow us to sketch a more accurate graph?

EXERCISE 3

1. Please sketch the rectangular hyperbola $y = -4 - \frac{2}{3x-3}$, and:

   A. Find and label the hyperbola's vertical asymptote

   B. Find and label the hyperbola's horizontal asymptote

   C. Find and label the point (x, y) which is the centre of the rectangular hyperbola

   D. Express the function in the form $y = a + b\frac{c}{x-d}$, where x does not have a coefficient, and hence state what transformations have been applied to $y = \frac{1}{x}$ to produce $y = -4 - \frac{2}{3x-3}$

   E. Find and label the coordinates of the two points on $y == -4 - \frac{2}{3x-3}$ where $y = -(x-1) - 4$