

Directions: Work in groups of 2-3. You may need extra paper.

**1** .

1. Describe the horizontal asymptotes, if any, of the following functions. (by taking  $\lim_{x \rightarrow \pm\infty} f(x)$ )

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

(b)  $f(x) = \frac{2x^5 - 2x^3 + 18}{x^4 + x^2 - x + 2}$

(c)  $f(x) = \frac{2x^5 - 2x^3 + 18}{x^4 + 3x^3 - x + 2} - 2x$

2. Find  $\lim_{x \rightarrow \infty} x^{25}e^{-x}$ .

3. Find  $\lim_{x \rightarrow \infty} \frac{x}{\ln x}$ .

4. Find  $\lim_{x \rightarrow \infty} \frac{\cos x}{\ln \ln x}$ .

**2** Evaluate the limit  $\lim_{x \rightarrow \frac{\pi}{2}^-} (\tan x)^{\cos x}$  using methods from calculus.

**3** Sketch the graph of a function  $f(x)$  that satisfies all of the following conditions.

- $f$  is odd
- $f'(x) < 0$  for  $0 < x < 2$
- $f'(x) > 0$  for  $x > 2$
- $f''(x) > 0$  for  $0 < x < 3$
- $f''(x) < 0$  for  $x > 3$
- $\lim_{x \rightarrow \infty} f(x) = -2$

**4** The figure shows the graph of the derivative  $f'$  of a function  $f$ .

- (a) Darken in the intervals on the  $x$ -axis where  $f$  is increasing.
- (b) For what values of  $x$  does  $f$  have a local minimum?
- (c) Sketch the graph of  $f''$  on the same axes using a dashed line.
- (d) Sketch a possible graph of  $f$  on the same axes using a regular line.

