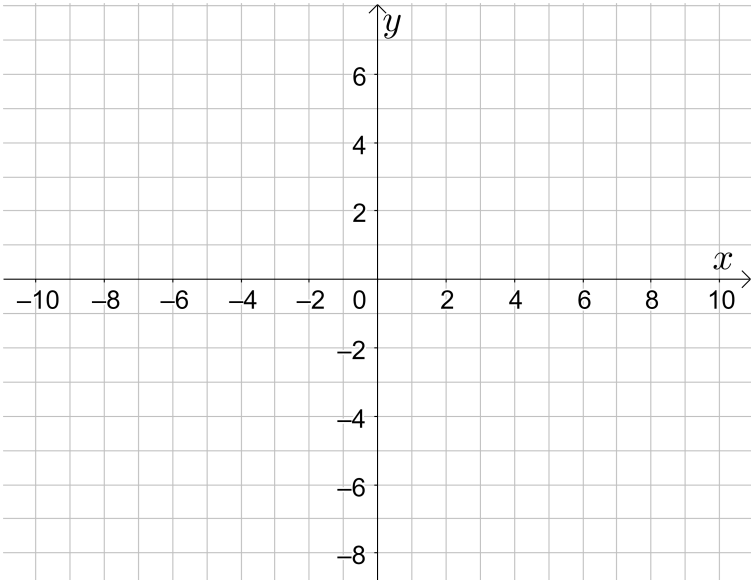
1. Given $f(x) = \dfrac{5}{x} + x\ln(5x-3)$ find $f''(x)$.

2. If the domain of $f(x)$ is $(-\infty,-3)\cup(-3,\infty)$ and $f''(x) = \dfrac{(x+5)(x-2)^2}{x+3}$, determine the intervals on which $f(x)$ is concave up and concave down and determine where the inflection points occur.

3. Use the second derivative test for local extrema to find (and classify) the local extrema of $f(x) = \dfrac{2}{3}x^3 + \dfrac{5}{2}x^2 - 12x + 20$.

4. Sketch a graph of $f(x)$ given the following information:
   - Domain of $f(x)$ is $(-\infty,-3)\cup(-3,\infty)$
   - $f(-7)=3$, $f(2)=3$, $f(6)=6$, $f(8)=8$
   - $x=-3$ is a vertical asymptote
   - $f'(x)>0$ on $(2,8)$
   - $f'(x)<0$ on $(-\infty,-3),(-3,2),(8,\infty)$
   - $f''(x)>0$ on $(-\infty,-7),(-3,6)$
   - $f''(x)<0$ on $(-7,-3),(6,\infty)$



5. Find the equation of the line tangent to the graph of $f(x)=3x^2+e^x-4\ln x$ at $x=1$.

6. The profit function for a company that makes and sells backpacks is given by $P(x) = -0.2x^2 + 460x - 8000$, where $P(x)$ is the profit in dollars when x backpacks are made and sold.

   (a) Estimate the profit from making and selling the 1,125$^{\text{th}}$ backpack.

   (b) Find the exact profit from making and selling the 1,125$^{\text{th}}$ backpack.

7. If $f(x) = \dfrac{x(2^x - 4)^3}{\log_3(8 - 7x^2)}$, what is $f'(x)$?

8. If $f(2) = 2$, $f'(2) = -1$, $f(4) = 0$, $f'(4) = 1$ $g(2) = 3$, $g'(2) = 5$, and $h(x) = \dfrac{4f(x^2)}{x \cdot g(x)}$, what is $h'(2)$?

9. Find $\frac{dy}{dx}$ if $x^2y^3 + 2x^3 - 4y^2 = x$.

10. A ship is observed to be 5 miles due north of port and travelling due south at 2 miles per hour. At the same time, another ship is observed to be 12 miles due west of port and travelling due east on its way back to port at 3 miles per hour. What is the rate at which the distance between the ships is changing at that time?

11. Given the graph of $f'(x)$ below and the domain of $f(x)$ is $(-\infty, \infty)$, find (a) the intervals on which $f(x)$ is increasing/decreasing, (b)the x-value for which $f(x)$ has local extrema (and classify), (c) the intervals on which $f(x)$ is concave up/concave down, and (d)the x-value for which $f(x)$ has inflection points.