

NOTE : These are only practice problems!

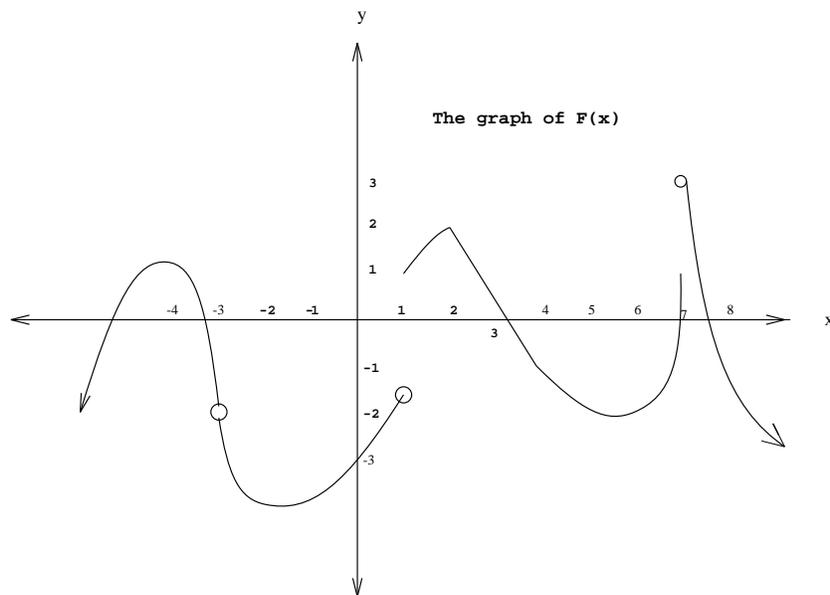
The number of problems in the exam will be less than this review.

You are responsible to study **all** the material and should be able to do also **all** homework problems!

- Let $f(x) = \sqrt{x^2 + 3x - 40}$, $g(x) = \frac{1}{x}$
 - Find $g(f(x))$ and $f(g(x))$.
 - Find the domain of $g(f(x))$.
- Find the value of each of the following limits in 3 different ways: analytically (exactly), graphically (illustrating the limit on a graph) and numerically (give a numerical evidence for the limit).
 - $\lim_{x \rightarrow 2} \frac{x^2 - 5x + 6}{x^2 - 4}$
 - $\lim_{x \rightarrow 4} \frac{x^2 - 5x + 6}{x^2 - 4}$
 - $\lim_{x \rightarrow \infty} \frac{3x^4 + 10x + 7}{2x^4 - 5x^3}$
- Let $g(x) = x^3 + x + 100$. **Without graphing** the function g , explain why there is at least one number $c \in (-5, 1)$ such that $g(c) = 0$. **Don't try to find c!**
- The tangent line to the curve of some unknown function $g(x)$ at $x = 3$ is $2y + x = 6$. What is $g(3)$? What is $g'(3)$?
- Let

$$f(x) = \begin{cases} x^3 + 2 & x > 1 \\ C & x = 1 \\ 5x - 2 & 1 > x \geq 0 \\ x^2 - 2 & x < 0 \end{cases}$$
 - For what value of C is f continuous at $x = 1$? **Explain!**
 - Is f continuous at $x = 0$? **Explain!**
 - Find the following limits : $\lim_{x \rightarrow 2} f(x)$, $\lim_{x \rightarrow (-1)} f(x)$
 - Is $f(x)$ differentiable at $x = 0$? **Explain!**
 - Check your answers to b) and d) by sketching the graph of $f(x)$ on the interval $[-1, 1)$.
- Use the definition of the derivative as a limit to find the derivative of $f(x) = x^2 + 2$.
- Sketch a possible graph of F on $[-4, 4]$ such that:
 F is continuous on $[-4, -1)$ and $(-1, 4]$, $\lim_{x \rightarrow -1^-} F(x) = 5$, $\lim_{x \rightarrow -1^+} F(x) = 2$, F is not differentiable only at $x = -1$ and $x = 1$.
- Find the equation of the tangent line to the curve given by the **implicit** function
 $y^2 - xy = x^2 + y - 6$ at $(2, 1)$.
- Let $h(x) = f(g(x))$. Assume that $f'(2) = 5$, $g(1) = 2$ and $g'(1) = 12$. What is $h'(1)$?
- Find the derivative of the following functions. Don't simplify!
 - $f(x) = \sqrt[5]{x^3} + \frac{6}{x^{3/8}} + x^3 + 7$
 - $g(x) = (x + 3x^9) * (x^5 - 7x)$
 - $h(x) = \left(\frac{x^2 + 3x}{x^6 - 9x}\right)^5$
 - $k(x) = \sqrt[3]{x^7 + 5x^2 - 50}$

11. a) Find the second derivative of the function $F(x) = 5\sqrt{x}$
 b) Find $\frac{d^9 g}{dt^9}$ where $g(t) = 120t^7 + t^6 - 62t^4 + 930$
12. Suppose that the total monthly cost function (in dollars) associated with manufacturing x Starview brand telescopes is given by $C(x) = 6,000 + 4x$ when $0 \leq x \leq 10,000$. The wholesale **unit** price is $f(x) = 120 - 0.001x$ when x denotes the monthly quantity demanded.
Recall that the revenue is given by $xf(x)$ and the profit by $P(x) = R(x) - C(x)$.
 a) Find the daily revenue function $R(x)$.
 b) Find the daily profit function $P(x)$.
 c) Find the daily marginal profit function.
 d) Find the approximate actual profit realized from the sale of the 4,000th telescope.
13. The demand function for a Starview brand telescope cover is $p = 35 - 0.02x^2$ where p is the unit price in dollars and x is the quantity demanded each week. How fast is the quantity demanded changing when $x = 100$ and the unit price per cover is increasing at a rate of 50 cents per week?



14. Use the given graph of F to do a), b), and c) for $x = a$ where $a = -3, 0, 1, 2, 6, 7$.
- a) What is $\lim_{x \rightarrow a} F(x)$? If the limit does not exist, write DNE **and** explain why.
 b) Is F continuous at $x = a$? If F is discontinuous at $x = a$, explain why.
 c) Is F differentiable at $x = a$? If F is not differentiable at $x = a$, explain why.