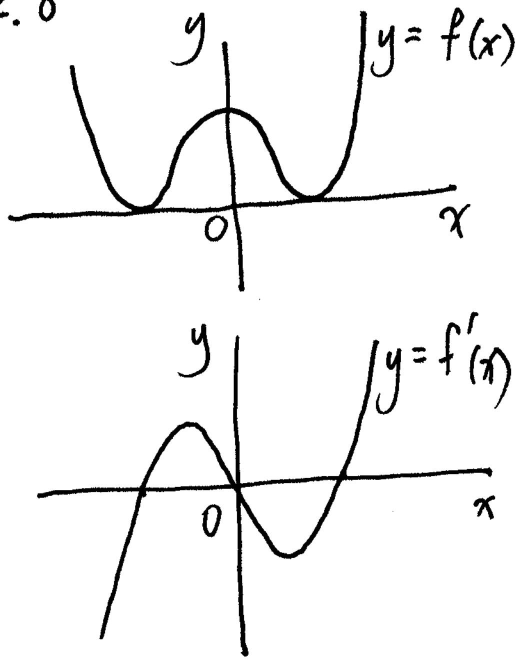
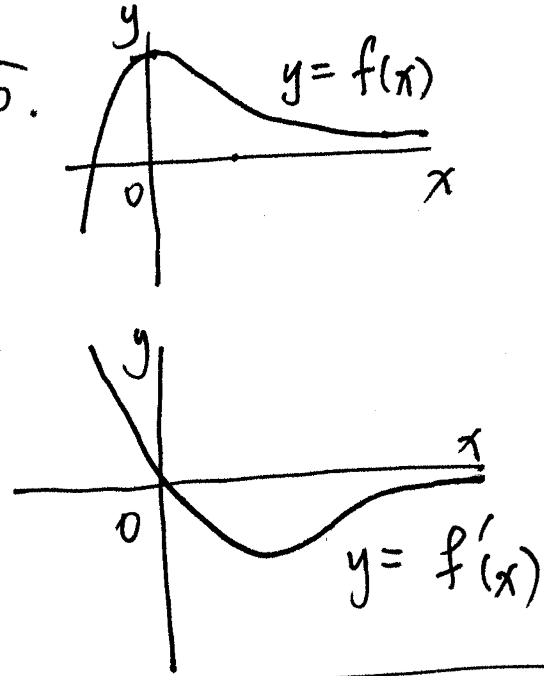
MATH 2200- SOLUTIONS TO HW6

Sec 2.8

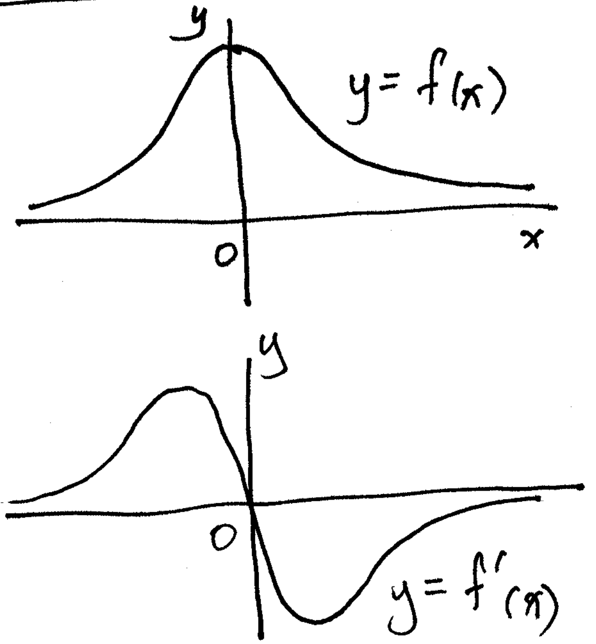
#4.



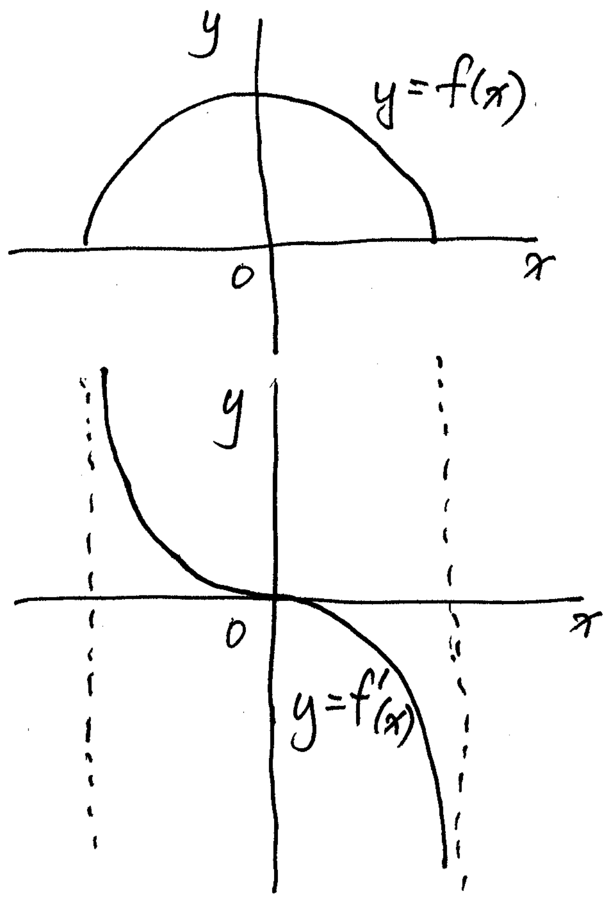
#5.



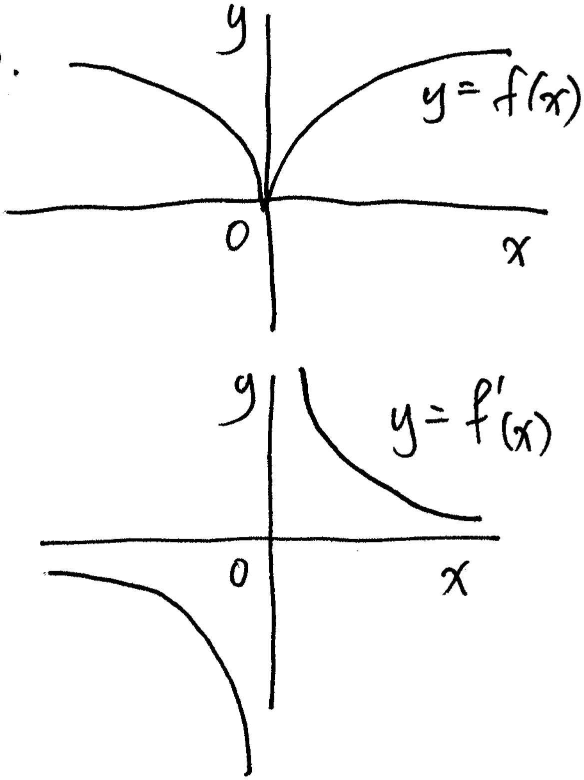
#6.



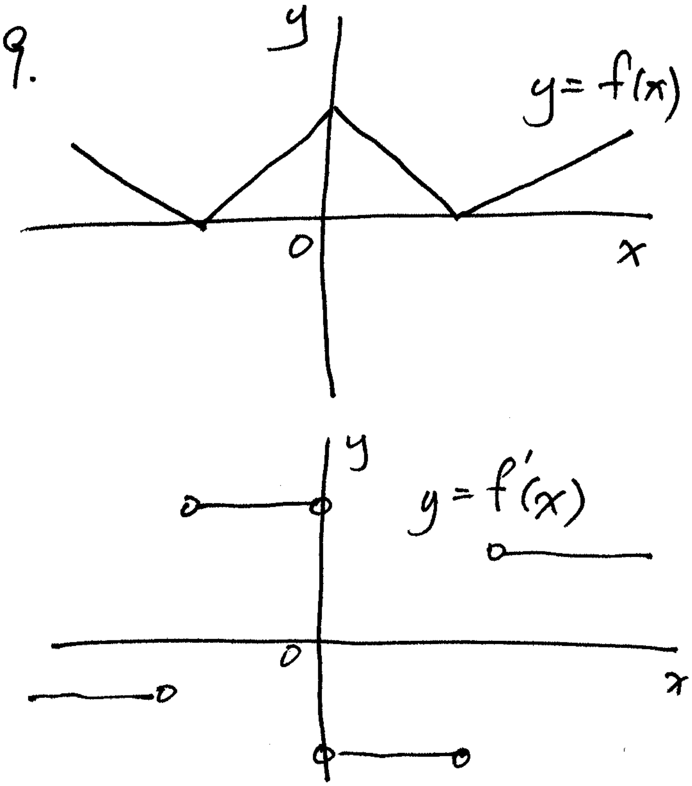
#7.



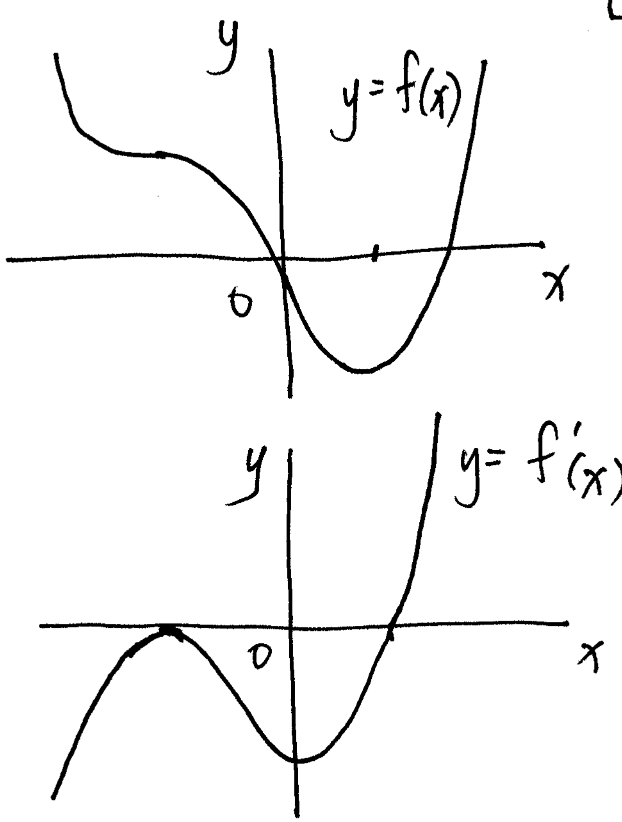
#8.



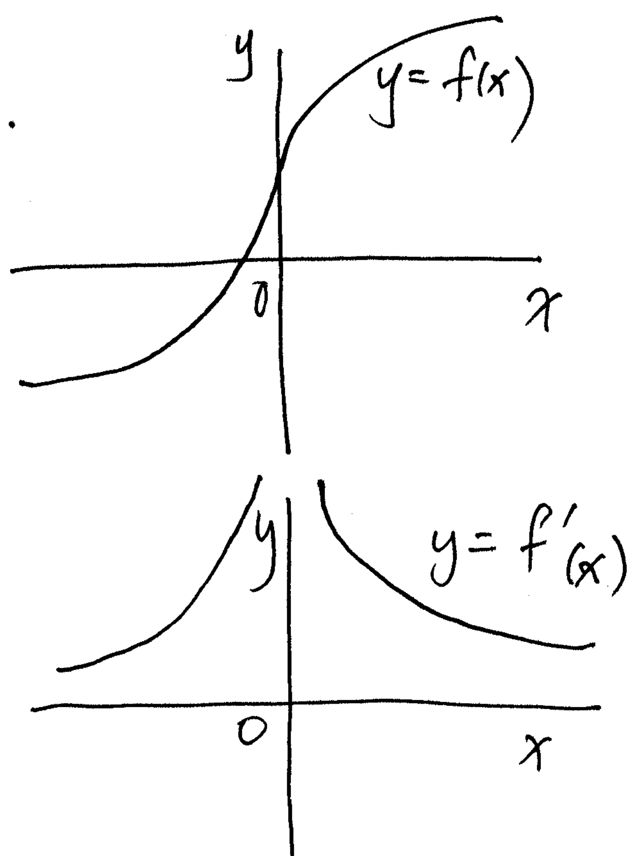
#9.



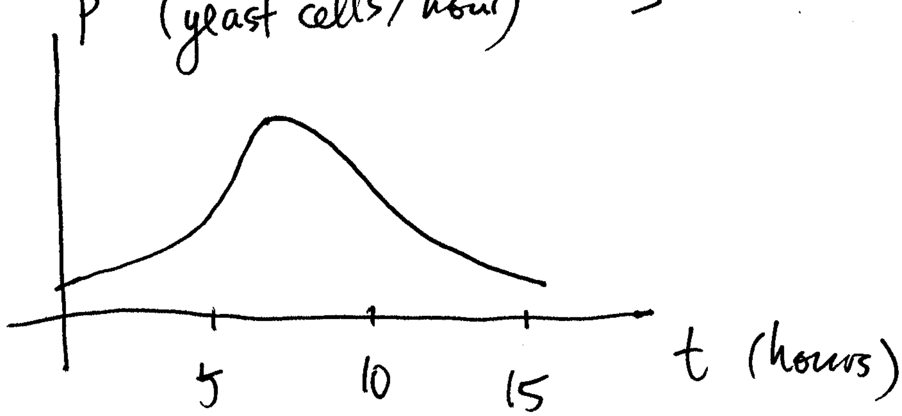
#10.



#11.



#12.



Since $P'>0$, we see that the yeast population is growing throughout the time interval under consideration. Since P' has a maximum at $t=7$ hours, this is the point in time at which the yeast population was growing fastest.

#20. $f(x) = 1.5x^2 - x + 3.7$ for all x (domain $= (-\infty, \infty)$)

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

$$= \lim_{h\to 0} \frac{1.5(x+h)^2 - (x+h) + 3.7 - 1.5x^2 + x - 3.7}{h}$$

$$= \lim_{h\to 0} \frac{3hx + 1.5h^2 - h}{h}$$

$$= \lim_{h\to 0} (3x + 1.5h - 1) = 3x - 1 \text{ for all } x$$

(domain $= (-\infty, \infty)$).

#32. f is not differentiable at 0, 3. At 0 it is not even continuous! At 3 it is continuous but its graph has a cusp, hence no tangent line.

#38. d: f

c: f' (Note that the local maximum and local minimum of the curve d are x-intercepts of the curve c, and only c.)

b: f'' (The curve c decreases on $(-\infty, 0)$ and increases on $(0, \infty)$ so the sign of its derivative is negative, then positive as shown in curve b, but not a.)

a: f''' (The curve b is increasing everywhere but with a horizontal tangent at $(0,0)$; so its derivative is positive, except at 0 where the derivative is zero. The graph a therefore represents the derivative of the curve b.)

Sec 2.9

#5. Denote by $D(t)$ the deficit, in dollars, at time t in years. Since the deficit is increasing, we have $D'(t) > 0$ at the current time t; but since the rate of increase of the deficit is decreasing, we have $D''(t) < 0$.

#6. (a) The rate of population increase is positive, with a maximum at about $t = 8$ hours.

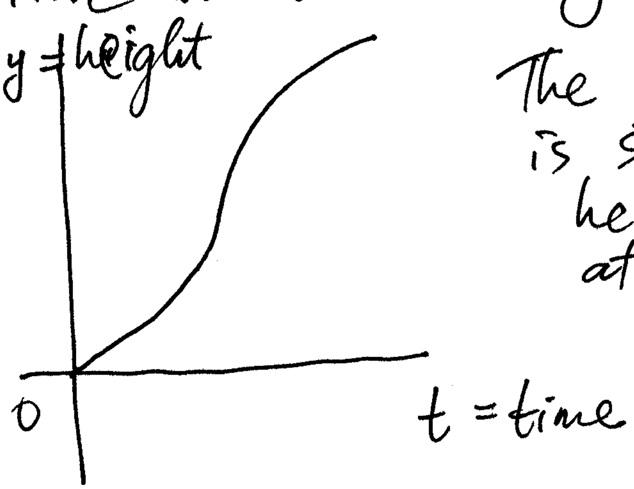
(b) The rate is highest at about $t = 8$ hours.

(c) The graph is concave up on $(0, 8)$ and concave down on $(8, 18)$.

(d) The inflection point is at approximately $(8, 320)$.

#9. For many students, $K(3)-K(2)$ (the amount learned just in the third hour) is greater than the amount learned during just the eigth hour $(K(8)-K(7))$. This is natural due to the effects of fatigue, which result in a slower rate of learning after too much studying. For the same reasons, the graph of K would tend to be concave down (since $K'(t)$ is positive but decreasing due to fatigue).

#10.



The slope of the graph is steepest when the height of the coffee is at the middle of the mug where the radius is smallest. Here the height rises at the fastest rate, giving an inflection point in the graph. The graph is concave up to the left of the inflection point (since the slope is increasing) and concave down thereafter (since the slope is then decreasing).

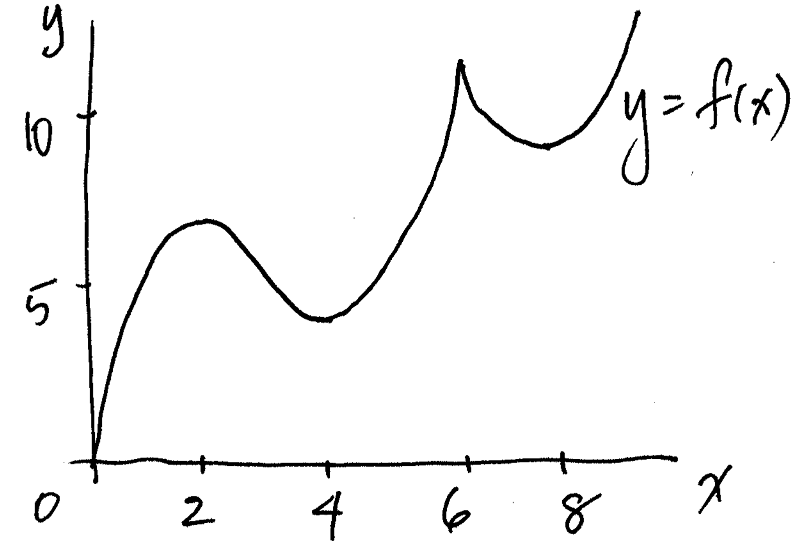
#11. (a) f is increasing on $(0,2)$, $(4,6)$ and $(8,9)$; it is decreasing on $(2,4)$ and on $(6,8)$.

(b) f has local maxima at 2, 6 and local minima at 4, 8.

(c) f is concave up on $(3,6)$ and on $(6,9)$; it is concave down on $(0,3)$.

(d) the inflection point of f occurs at $x=3$.

(e)



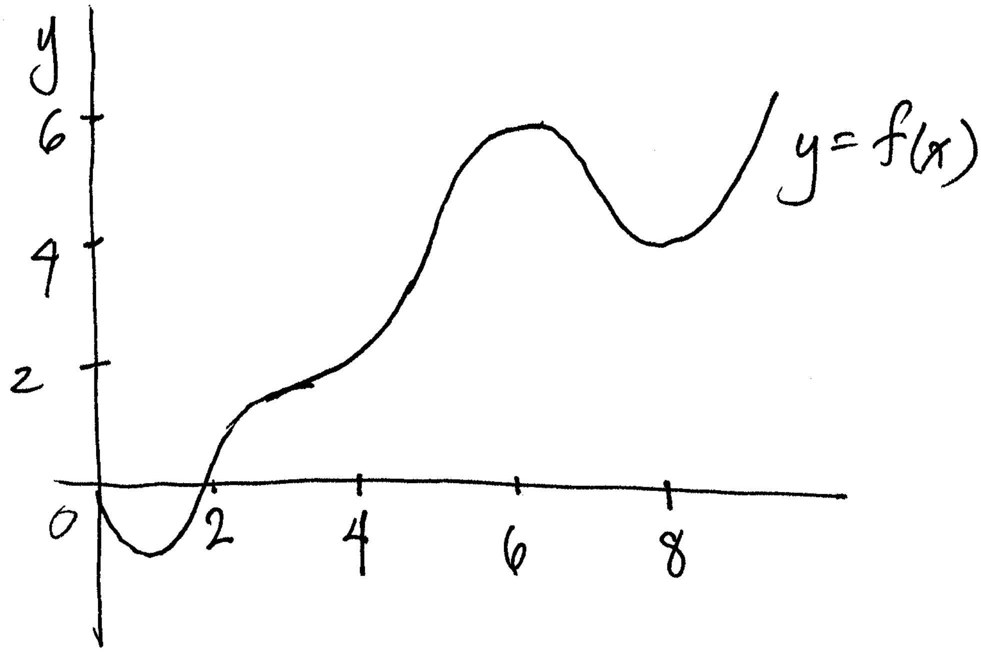
#12. (a) f is increasing on $(1,6)$ and on $(8,9)$; it is decreasing on $(0,1)$ and on $(6,8)$.

(b) f has a local maximum at 6 and local minima at 1, 8.

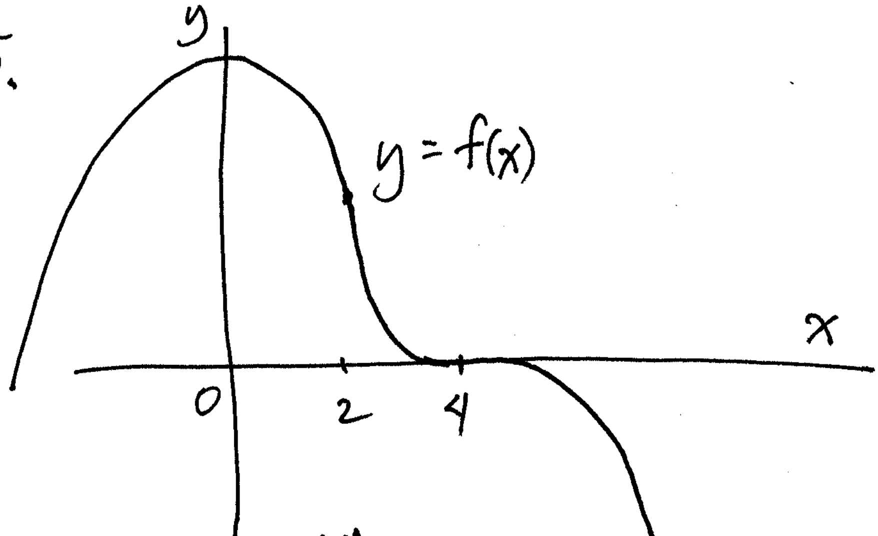
(c) f is concave up on $(0,2)$, $(3,5)$ and $(7,9)$; it is concave down on $(2,3)$ and on $(5,7)$.

(d) The inflection points of f occur at $x=1, 6, 8$.

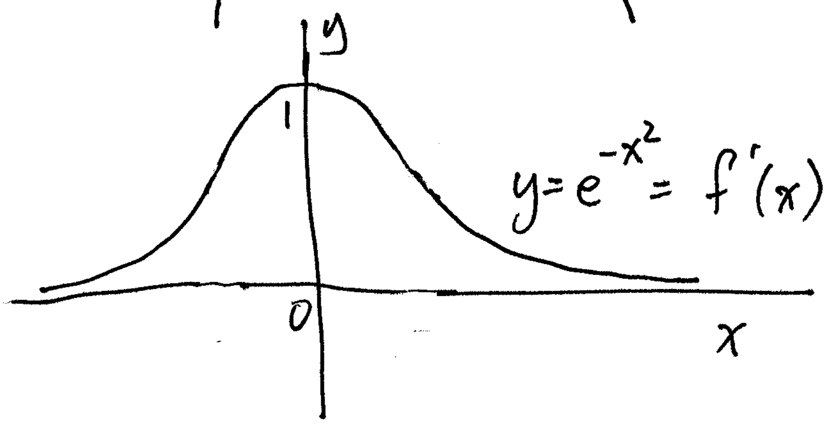
(e)



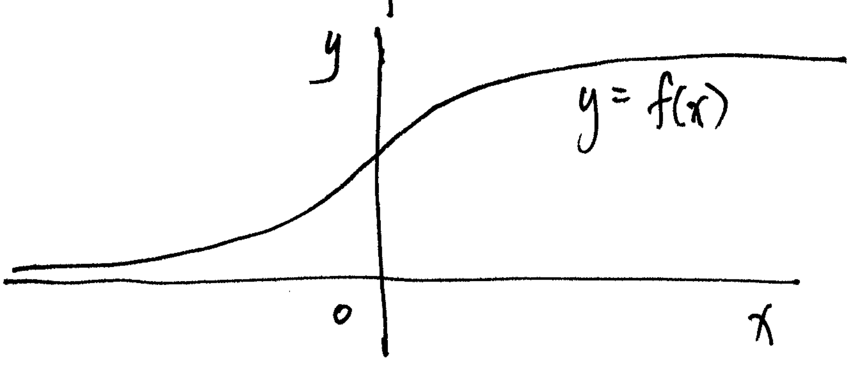
#15.



#22.



$f'>0$ with a maximum at $(0,1)$.



So:

f is increasing; it is concave up on $(-\infty,0)$ and concave down on $(0,\infty)$ with an inflection point at $x=0$.