(15 pts) In 1990, the population of Mexico was about 84 million and approximated by $P(t) = 84(1.026)$ (in millions), where t is in years since 1990.

(a) (6 PTS) What was the rate of growth in the year 1995 (give the units)?

$$P(t) = 84(1.026)^t = 84 \cdot e^{t \ln(1.026)}$$

$$P' = \ln(1.026) \cdot 84 \cdot e^{t \ln(1.026)} = \ln(1.026) \cdot 84(1.026)^t$$

$$\Rightarrow P'(5) \cong 2.45$$

(b) (2 PTS) What is the practical interpretation of $P'(0) = 2.15$?

in 1990 (i.e. $t=0$) the population is increasing at a rate of 2.15 million people/year

(c) (2 PTS) What is the practical interpretation of $P^{-1}(112) = 5$?

in 1995 (i.e. $t=5$) the population is 112 million

(d) (5 PTS) In what year will the population reach 150 million?

$$150 = 84\, e^{t \ln(1.026)} \Rightarrow \ln\left(\frac{150}{84}\right) = t \ln(1.026)$$

$$\Rightarrow t = \frac{1}{\ln(1.026)} \cdot \ln\left(\frac{150}{84}\right) \simeq 22.59$$

(10 pts) Use the table of values for f, f', g and g' to find:

(a) (5 PTS) If $K(x) = \dfrac{f(x)}{g(x)}$ then $K'(4) = \underline{-46}$?

$$K'(4) = \frac{f'(4)g(4) - g'(4)f(4)}{g^2(4)} = \frac{6(-1) - 5 \cdot 8}{(-1)^2} = -46$$

(b) (5 PTS) If $H(x) = f(x)g(x)$ then $H'(-2) = \underline{41}$

x	f(x)	f'(x)	g(x)	g'(x)
-2	3	5	7	2
3	0	-4	1	3
4	8	6	-1	5

$$H'(-2) = f'(-2)g(-2) + f(-2)g'(-2)$$

$$= 5 \cdot 7 + 2 \cdot 3 = 41$$