

Sec. 7.7 Exponential Growth and Decay

$$y = a \cdot b^x, \quad \begin{array}{l} b > 1 \text{ growth} \\ a > 0 \end{array}$$

Problem 1: Since 2005, the amount of money spent at restaurants in the U.S. has increased about 7% each year. In 2005, about \$360 billion was spent at restaurants.

About how much will be spent in 2015?

$$\rightarrow y = a \cdot b^x$$

$x \rightarrow$ time (# of yrs)

$a \rightarrow$ starting amount

$b \rightarrow (1+r)$

$$y = 360 \cdot (1.07)^{10}$$

$$1.07 \boxed{y^x} 10 \boxed{=} \boxed{x} 360$$

\wedge

\$708 billion

Your parents invest \$20,000 in an account paying 5% compounded annually. What will be the balance after 6 years?

$$y = ab^x \rightarrow y = 20,000 \cdot (1.05)^6$$

$$y = 26,801.91$$

.91?

Compound Interest

$$A = P(1+r)^t \rightarrow \text{yearly}$$

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

rate
time in years

principal

n = # of times interest is compounded each year

Your parents deposit \$20,000 into an account that pays 4.5% interest compounded quarterly. What will the balance be in 6 years?

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

4.5% → 0.045 n = 4 5% → 0.05

$$A = 20,000 \left(1 + \frac{0.045}{4}\right)^{4 \cdot 6}$$

$$\text{\$}26,159.82$$

$$A = 20,000 \left(1 + \frac{0.05}{4}\right)^{4 \cdot 6}$$

$$\text{\$}26,947.02$$

Decay $a \cdot b^x$, $a > 0, 0 < b < 1$

$$y = 3 \cdot \boxed{0.79^x} \rightarrow \text{decay} \quad y = a(1-r)^t$$

The atmospheric pressure at sea level is about 105 kilopascals. For every 1000-m increase in altitude, the pressure decreases 11.6%. What is the pressure at altitude 2000m?

$$\begin{aligned} y &= 105(1 - .116)^2 \\ &= 105(0.884)^2 \\ &\approx 82 \text{ kilopascals} \end{aligned}$$