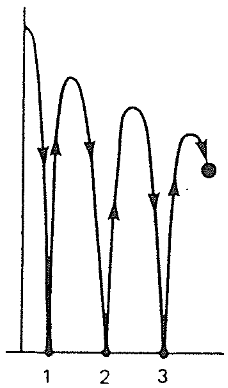
Section 11.1

2. ***Chewing Gum Problem*** Anne X. Kewse gets caught chewing gum in algebra class. Quickly, she explains to her instructor that she is conducting a practical experiment in geometric sequences and series, since with each chew she gets 0.9 times as much flavor as she did with the preceding chew.
   a. If she gets 40 squirts of flavor with the first chew, how many squirts will she get with the tenth chew?
   b. What total amount of flavor will she get in the first 10 chews?
   c. Her punishment is to chew the gum *forever*. What total amount of flavor will she recieve?

6. ***Little Brother Problem*** Your little brother is hard up for cash, and asks you to lend him 10 cents. You get him to agree to pay 5% per day interest, compounded daily. You lend him the money, but you both forget the deal until exactly one year later. Being an expert at geometric sequences, you perform some calculations which show he is deeply in debt.
   a. How much does he owe you for a 365-day year?
   b. How much *more* would he owe you for a 366-day leap year?

4. ***Bouncing Ball Problem*** Suppose that you drop a superball from a window 20 meters above the ground. The ball bounces to 90% of its previous altitude with each bounce.



a. How far does the ball travel, up and down, between the first and the second bounce?
b. Show that the numbers of meters the ball travels up and down between bounces are terms of a geometric sequence.
c. Find the number of meters the ball travels up and down between the sixth and seventh bounce.
d. Find the total number of meters the ball travels between the first bounce and the seventh bounce.
e. If the ball continues to bounce in this manner until it comes to rest, how far will it have traveled, up and down, from the time it was dropped from the window?

5. ***George Washington Problem*** Recently, Anna Ward found she is a distant relative of George Washington. When he died in 1799, he left \$1000 in his will, which now belongs to her. The money has been in a savings account at the Old Dominion Bank, where it has been earning interest at 5% per year, compounded annually (once a year). How much does Anna have *this* year? Why do you suppose that there are laws limiting a bank's liability for paying interest on dormant savings accounts?

Section 11.1

Lesson 114

Applications

ask: a term or a sum
↓ sequence ↓ series

2. ***Chewing Gum Problem*** Anne X. Kewse gets caught chewing gum in algebra class. Quickly, she explains to her instructor that she is conducting a practical experiment in geometric sequences and series, since with each chew she gets 0.9 times as much flavor as she did with the preceding chew. $\to r = .9$
 a. If she gets 40 squirts of flavor with the first chew, how many squirts will she get with the tenth chew? a term
 b. What total amount of flavor will she get in the first 10 chews? sum
 c. Her punishment is to chew the gum *forever*. What total amount of flavor will she recieve?

ⓐ $t_1 = 40 \quad t_{10} = ?$

$t_{10} = 40 \cdot (.9)^{10-1}$

$t_{10} \approx 15.49$

15 squires

ⓑ $S_{10} = t_1 \dfrac{1-r^n}{1-r}$

$= 40 \cdot \dfrac{1-.9^{10}}{1-.9}$

≈ 260.528

261 squires

ⓒ $S = \dfrac{t_1}{1-r}$

$= \dfrac{40}{1-.9}$

$=$ 400 squires

6. ***Little Brother Problem*** Your little brother is hard up for cash, and asks you to lend him 10 cents. You get him to agree to pay 5% per day interest, compounded daily. You lend him the money, but you both forget the deal until exactly one year later. Being an expert at geometric sequences, you perform some calculations which show he is deeply in debt. $r = 1.05$
 a. How much does he owe you for a 365-day year? term
 b. How much *more* would he owe you for a 366-day leap year? term

n =	1	2	3	4	n
days	0	1	2	3	... n
owes	.10	$.10(1.05)^1$	$.10(1.05)^2$	$.10(1.05)^3$	$.10(1.05)^n$

S_{365}

$t_n = t_1 \cdot r^{n-1}$

ⓐ $t_{365} = .10(1.05)^{365} = \$5,421,184.16$ $(366-1)$

ⓑ $t_{366} = .10(1.05)^{366} = \$5,692,243.37$ $(367-1)$

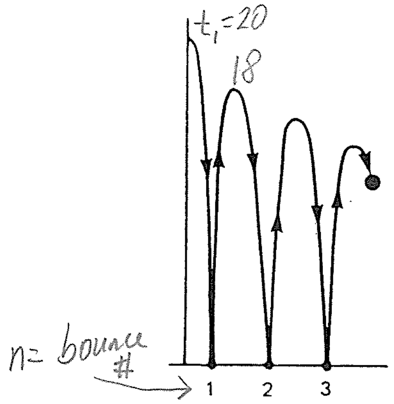
$5,692,243.37 - 5421,184.16 = \$271,059.21$ more

4. ***Bouncing Ball Problem*** Suppose that you drop a superball from a window 20 meters above the ground. The ball bounces to 90% of its previous altitude with each bounce.

$r = .9$

$t_1 = 20$

classic sequence series problem.



a. How far does the ball travel, up and down, between the first and the second bounce? $t_2 - t_1$

classic Qs

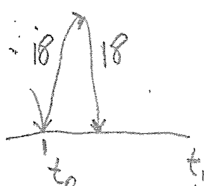
b. Show that the numbers of meters the ball travels up and down between bounces are terms of a geometric sequence.

c. Find the number of meters the ball travels up and down between the sixth and seventh bounce.

d. Find the total number of meters the ball travels between the first bounce and the seventh bounce.

e. If the ball continues to bounce in this manner until it comes to rest, how far will it have traveled, up and down, from the time it was dropped from the window?

a) $t_1 = 20 \cdot 0.9^1 = 18 \rightarrow 18 + 18 = 36\,m$



b) $\underset{t_0}{20}, \quad \underset{\text{bounce 1}}{\overset{t_1}{20(.9)^1}}, \quad \underset{\text{bounce 2}}{\overset{t_2}{20(.9)^2}}, \quad \overset{t_3}{20(.9)^3} \ldots \therefore \overset{t_n}{t_n = 20(.9)^n}$

c) $t_6 = 20(.9)^6 = 10.62882 \times 2 = 21.257 \Rightarrow 21.3\,m$ — explain why S_6 and not S_7

d) $2(S_6) = t_1 \cdot \frac{1-r^n}{1-r} = 18 \cdot \frac{1-.9^6}{1-.9} = 84.34 \times 2 = 168.68\,m$ checks out with adding distances of 7 bounces...

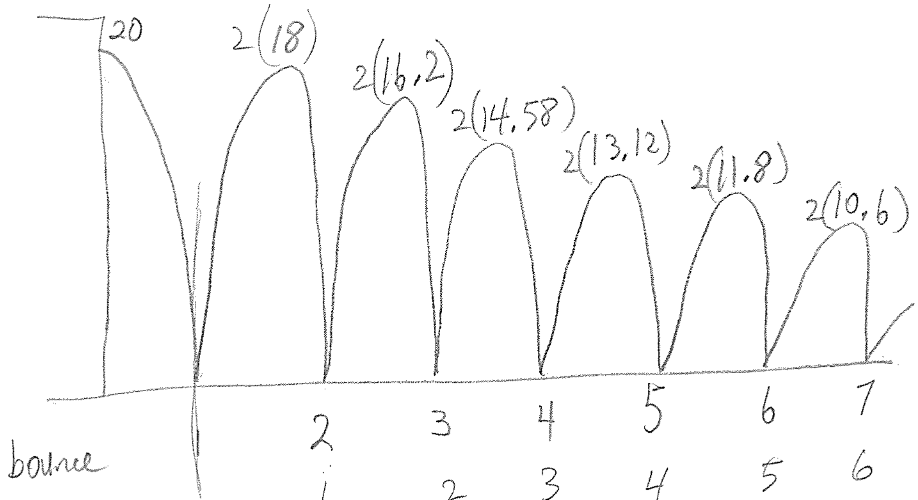
e) $20 + 2S \Rightarrow S = \frac{t_1}{1-r} = \frac{18}{1-.9} = 180 \qquad 2(180) + 20 = 380\,m$

5. ***George Washington Problem*** Recently, Anna Ward found she is a distant relative of George Washington. When he died in 1799, he left \$1000 in his will, which now belongs to her. The money has been in a savings account at the Old Dominion Bank, where it has been earning interest at 5% per year, compounded annually (once a year). How much does Anna have *this* year? Why do you suppose that there are laws limiting a bank's liability for paying interest on dormant savings accounts?

Year = 1991

#4

ⓓ



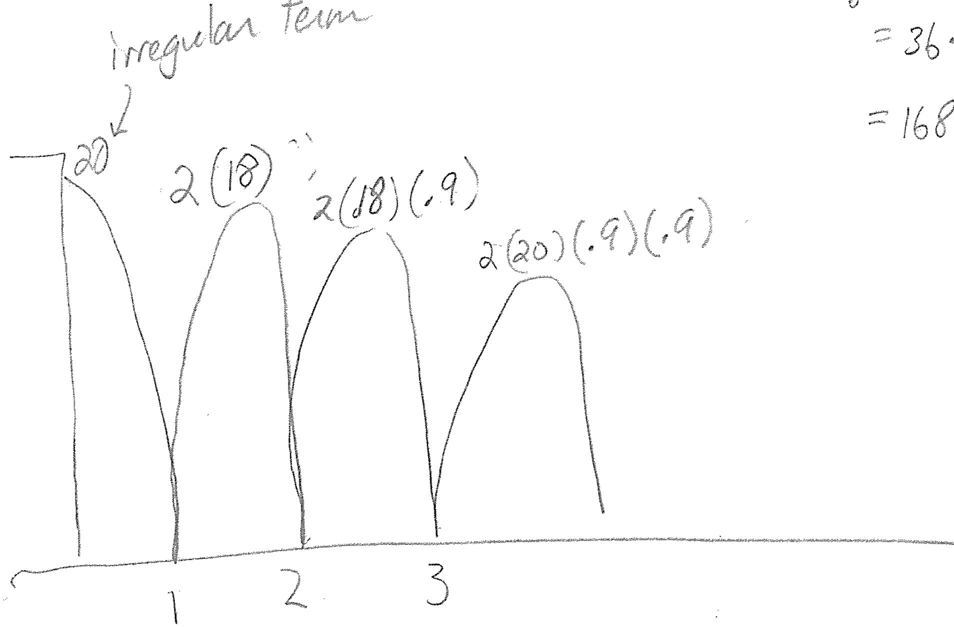
Totals 168.6

$S_6 = t_1 \frac{1-r^n}{1-r}$

$= 36 \cdot \frac{1-.9^6}{1-.9}$

$= 168.68$

e)



$t_1 = 2(18) \qquad r = .9 = \frac{9}{10}$

$$S = \frac{t_1}{1-\frac{9}{10}} = \frac{36}{\frac{1}{10}} = 360$$

$360 + 20 = 380$