☆ Warm Up ☆

TRY: setting up the base and power

Uranium decays by 18% 5 times a year

Home depreciates by 4% every 5 years 0.82^{5x}

Population grows by 2.4% every 2 years $0.96^{\frac{x}{5}}$

A valuable piece of jewellery appreciates by 4% 3 times a year $1.024^{\frac{x}{2}}$

School population triples every 10 years 1.04^{3x}

Carbon 14 has a half life of 5730 years $3^{\frac{x}{10}}$

(Be careful here this means that carbon decays to half of its mass every 5730 years)

$\left(\frac{1}{2}\right)^{\frac{x}{5730}}$

An antique car appreciates by 12% every 8 years $1.12^{\frac{x}{8}}$

Bacteria Culture doubles every year : 2^x

A stock price will decrease by 2.3% four times a year 0.977^{4x}

Homework SOLUTIONS

- What is the base and power

B

Increase by 15% every 3 years $1.15^{\frac{t}{3}}$

Decrease by 6.5% four times a year 0.935^{4t}

Increase by 1.3% every 9 months $1.013^{\frac{t}{9}}$

Decrease by 36% 6 times a week 0.64^{6t}

The population of Canada is increasing by 2.03% every two years. If the popuation of Canada is now 41 290 000, what will it be in 9 years



$$P(t) = 41290000(1.0203)^{t/2}$$

$$P(9) = 41290000(1.0203)^{9/2}$$

$$= 45\,738\,849 \text{ people}$$

EXAMPLE:

You invest $500 at a fixed annual interest rate of 12 % every 4 years. How much will you have after 20 years?

$$A(t) = 500(1.12)^{\frac{t}{4}}$$

$$A(t) = 500(1.12)^{\frac{20}{4}}$$

$$A(t) = \$881.17$$

EXAMPLE:

Your new travel trailer that you purchased for $43000 depreciates by 15% every 3 years. What is it worth in 20 years?

$$V(t) = 43000(0.85)^{\frac{t}{3}}$$

$$V(t) = 43000(0.85)^{\frac{20}{3}}$$

$$V(t) = \$14552.18$$

EXAMPLE:

You invest $4000 at a fixed annual interest rate of 5.2 % two times a year. How much will you have after 15 years?

$$A(t) = 4000(1.052)^{2t}$$

$$A(t) = 4000(1.052)^{2(15)}$$

$$A(t) = 18303.42$$

EXAMPLE:

Your new luxury SUV that you purchased for $85000 depreciates by 4% three times a year. What is it worth in 15 years?

$$V(t) = 85000(0.96)^{3t}$$

$$V(t) = 85000(0.96)^{3(15)}$$

$$V(t) = 13540.18$$

- Carbon has a half life of 5730 years. A 136mg sample of carbon is found, what will its mass be in 2500 years?

***means -->it decays half its of mass... every 5730 yrs.

$$M = 136\left(\frac{1}{2}\right)^{\frac{x}{5730}}$$

$$= 136\left(\frac{1}{2}\right)^{\frac{2500}{5730}}$$

$$= 100.5\text{mg}$$

- A bacteria culture contains 25 cells, it doubles 5 times a day. How many are there after 6 days?

$$B = 25(2)^{5t}$$

$$B = 25(2)^{5(6)}$$

B= a very bigggg number

2.68×10^{10} cells

The population of Toronto increases by 0.32% three times a year. If the initial population is 6,431,000, what will the population be in 18 months

Solution on next slide

The population of Toronto increases by 0.32% three times a year. If the initial population is 6,431,000, what will the population be in 18 months

t= 18 months

= 1.5 years

$$P(t) = 6431000(1.0032)^{3t}$$

$$= 6431000(1.0032)^{3(1.5)}$$

$$= 6\,524\,126.38 \text{ people}$$

Exponential Growth and Decay!

1. You purchase a car for $24500. The car depreciates by 17%/a. What is the car worth in 5 years?

2. A bacteria culture doubles 6 times a day. The initial number of bacterium is 100... how many bacteria are there after 2 days?

3. The population in NB is decreasing by 2.5% every 30 months. If the present population is 625000, what will the population be in 10years?

4. A $1500 painting goes up in value by 20% every 4 years, how much is it worth in 9 years?.

5. The number of people with the "math virus" triples every year. At present 5 people have the virus, how many will have it after 4 years?

6. John takes 500mg of a pain relieve, the drug decays at a rate 41% every hour. How much of the drug remains after 10 hours?

7. You invest $5000 at 8%/a. How much do you have after first three years

8. Radioactive platinum decays by 12% every month. If a sample has a mass of 20mg,
   a) how much remains after 24 months b) how much remain after 5 years?

9. You take 500mg of extra strength Tylenol. The Tylenol decays in your blood stream at a rate of 15% every half hour. How much remains after 6 hours?

10. The population of Moncton is growing at a rate of 6.3%every 2 years. If the population is 55000 today, what will it be in 20 years?

11. John buys an antique car for $25000, the car appreciates by 8% every 5 years, what is it worth in 12 years?

12. There are 50 bacteria cells in a petri dish, they double every 8 hours, how many will there be after 1 day?

Practice Problems:

Answers are on the next 16 pages

1 You purchase a car for $24500. The car depreciates by 17%/a.

100% - 17% = 83%

What is the car worth in 5 years?

100%-17% =83%

$V = 24500(0.83)^{t/1}$

$= 24500(0.83)^{5/1}$

$= \$9650.65$

2

A bacteria culture doubles 6 times a day. The initial number of bacterium is 100..., how many bacteria are there after 2 days?

$B = 100(2)^{6t}$

$100(2)^{6(2)}$

* 6 times a day
6t

~~$100(2)^{6\times 2}$~~

$100(2)^{(6\times 2)}$

409600

* every 6 days
t/6

CELLS

3 The population in NB is decreasing by 2.5% every 30 months. If the present population is 625000, what will the population be in 10years?

(time has to match)

100 − 2.5
97.5%
0.975

t in years

every 2.5 years
(30 months)

$t/2.5$

$P = 625000(0.975)^{t/2.5}$

$= 625000(0.975)^{10/2.5}$

$= 564804.9$

t in months

every 30 months

$t/30$

$P = 625000(0.975)^{t/30}$

$P = 625000(0.975)^{120/30}$

$= 564804.9$

PEOPLE

4.

A $1500 painting goes up in value by 20% every 4 years, how much is it worth in 9 years?.

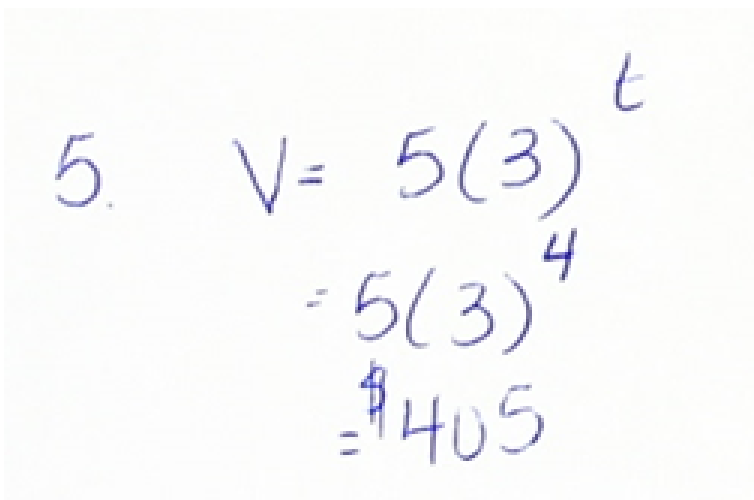
$V = 1500(1.20)^{t/4}$ $\rightarrow$ $1500(1.20)^{(9/4)}$

$= 1500(1.20)^{9/4}$

$\approx \$2260.73$

5

The number of people with the "math virus" triples every year. At present 5 people have the virus, how many will have it after 4 years?



6

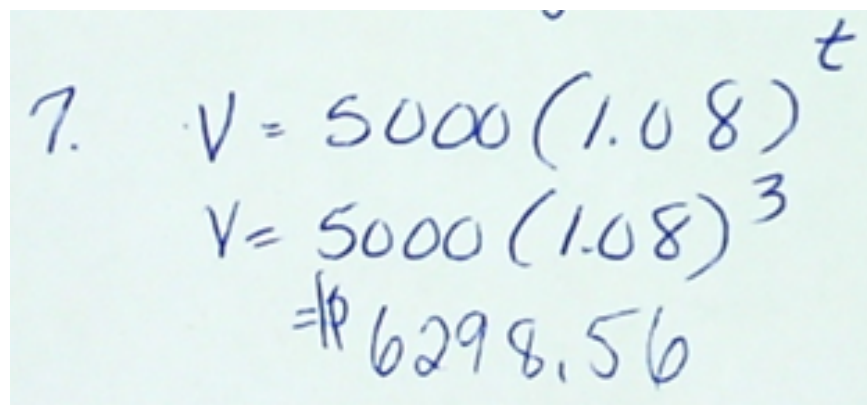
John takes 500mg of a pain reliever, the drug decays at a rate 41% every hour. How much of the drug remains after 10 hours?

6. $P = 500(0.59)^{t}$

$= 500(0.59)^{10}$

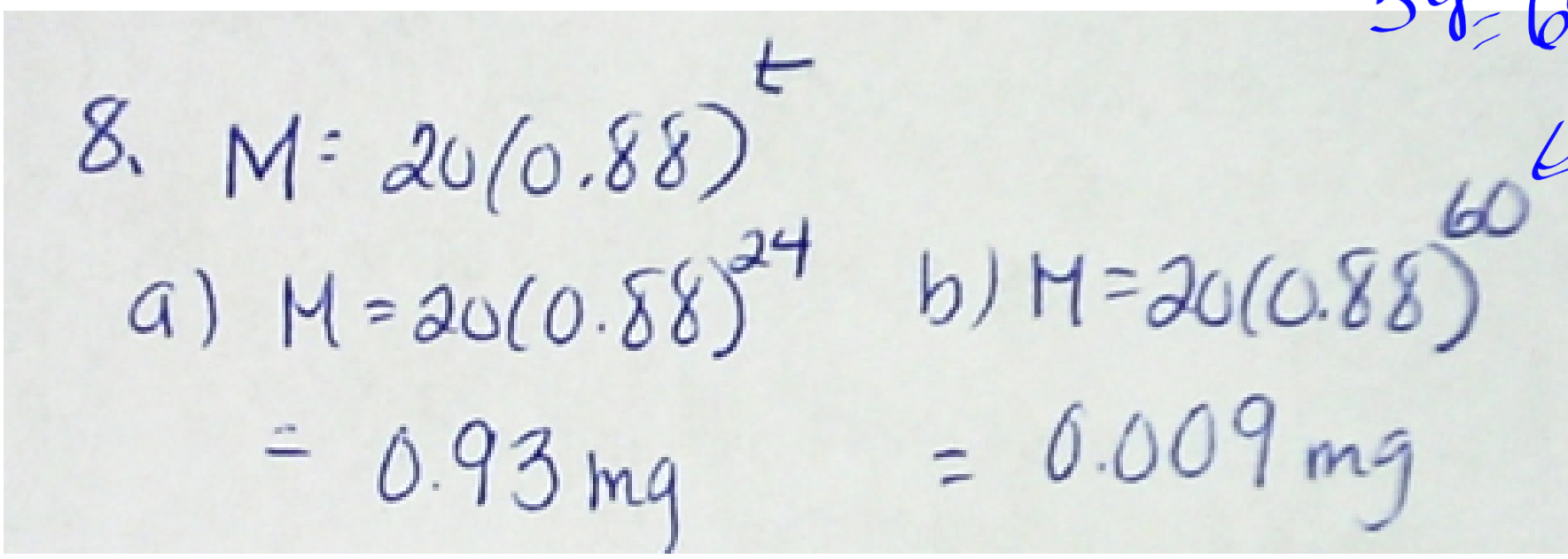
$= 2.556\ mg$

7. You invest $5000 at 8%/a. How much do you have after three years?



8

Radioactive platinum decays by 12% every month. If a sample has a mass of 20mg,
a) how much remains after 24 months
b) how much remain after 5 years?



9 You take 500mg of extra strength Tylenol. The Tylenol decays in your blood stream at a rate of 15% every half hour. How much remains after 6 hours?

$\frac{1}{0.5}$ time in hours

$M = 500(0.85)^{\frac{6}{0.5}}$

$500(0.85)^{12}$

$= 71.12\text{ mg}$

every 30min

6 hrs = 360min

$M = 500(0.85)^{\frac{360}{30}}$

$= 71.12\text{mg}$ *

or 2 min an hour

$2t$

$M = 500(0.85)^{2(6)}$

$= 500(0.85)^{2t}$

$= 71.12\text{mg}$

10

The population of Moncton is growing at a rate of 6.3% every 2 years. If the population is 55000 today, what will it be in 20 years?

t / 2yrs

Growing
100 + 6.3
106.3%
1.063

$P = 55000(1.063)^{t/2}$

$= 55000(1.063)^{20/2}$

$= 101320.0$ people

every 15min: t / 15min

every 6hours: t / 6hrs

4 times a day: $4t$ (days)

Twice a year $2t$ (years)

11

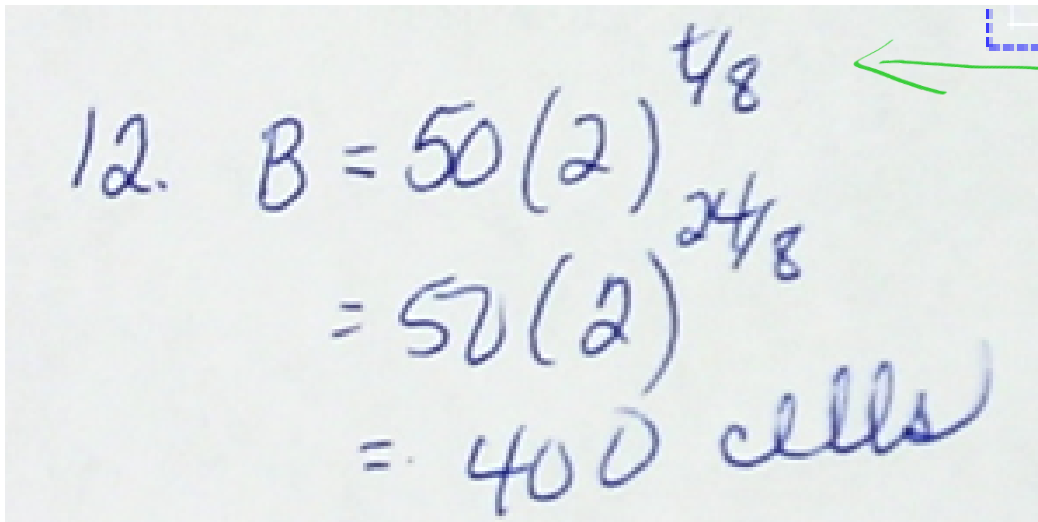
John buys an antique car for $25000, the car appreciates by 8% every 5 years, what is it worth in 12 years?

100 + 8
= 108%
1.08

11. $V = 25000(1.08)^{\frac{12}{5}}$
$= 25000(1.08)^{2.4}$
$= \$30071.63$

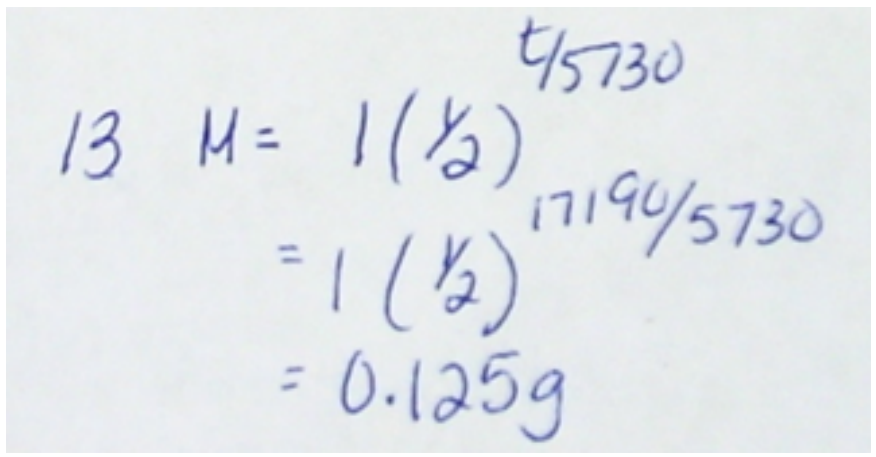
12

There are 50 bacteria cells in a petri dish, they double every 8 hours, how many will there be after 1 day?



13.

Carbon Dating is used to determine the year which ancient artifacts, especially fossils were buried in the earth. Every 5730 years a sample of Carbon14 weights half as much. This is called Half-life. After 17190 years, how much would a gram sample of Carbon14 weigh?



14. Jane invests $5000 in a fund that pays 4% three times a year. What will her investment be worth in 20 years?

$V = 5000(1.04)^{3t}$

$V = 5000(1.04)^{3(20)}$

$= 5000(1.04)^{60}$

$= \$52598.14$

$(100+4)\%$

104%

1.04

15 The population of Cains River is increasing by 1.2% every 5 years. If the popuation is now 123 (year 2016), what will it be in 2080?

100% + 1.2%

~~102~~ 101.2%

(1.012)

$P = 123(1.012)^{64/5}$

$= 123(1.012)^{64/5}$

$= 143.29$ people

144

16 Joe purchased a used vechile for $15600. The car will depreciate by 23% every 2 years, what will it be worth in 7 years?

$$V = 15600(0.77)^{t/2}$$

$$= 15600(0.77)^{7/2}$$

$$= \$11624.45$$