# Mathematics 11U

## 4.7 – Applications Involving Exponential Functions

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The exponential function equation is:

$f(x) = ab^x$

periods / time

final value

initial value

growth: $b = 1 + r$

decay: $b = 1 - r$

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bacteria grows at a rate of 5% : $b = 1 + 0.05$

$b = 1.05$

Doubles: $b = 2$

Triples: $b = 3$

Half-life: $b = \frac{1}{2}$

A population of 320 frogs grows at a rate of 4.5% per year. How many frogs will there be in 15 years?

$a = 320$

$r = 4.5\%$

$x = 15$ years

$f(x) = ab^x$

$b = 1 + 0.045$

$b = 1.045$

$f(15) = 320(1.045)^{15}$

$f(15) = 619.29$

$\therefore$ There are 619 frogs in 15 years

A new car depreciates at a rate of 20% per year. Steve bought a new car for $26,000.

a) How much will Steve's car be worth in 3 years?

decay

r

a

x

$f(x) = ab^x$

$f(3) = 26000(0.8)^3$

$f(3) = \$13,312$

$b = 1 - 0.2$

$b = 0.8$

b) When will Steve's car be worth $4000?

$4000 = 26000(0.8)^x$

try $x = 6$, $f(6) = \$6,815.74$

$x = 8$, $f(8) = \$4,362.08$

In about 8–9 years.

Unfortunately, its not always that simple….

rate – yearly
\monthly
– daily..

rate – every 3 years
– every 6 hours
– every 4 days

$f(x) = \$1(2)^{x/4}$

- how much in 8 days?
  $x = ??$

$f(8) = 1(2)^{8/4}$

$f(8) = 1(2)^{2}$

$f(8) = 4$

A 200g sample of radio-active material has a half-life of 138 days. How much will be left in 5 years?

$b = \frac{1}{2}$

$f(x) = 200\left(\frac{1}{2}\right)^{x/138}$

$365 \times 5 = 1825$ days

$f(1825) = 200\left(\frac{1}{2}\right)^{1825/138}$

$f(1825) = 0.019$ grams