

## WARMUP

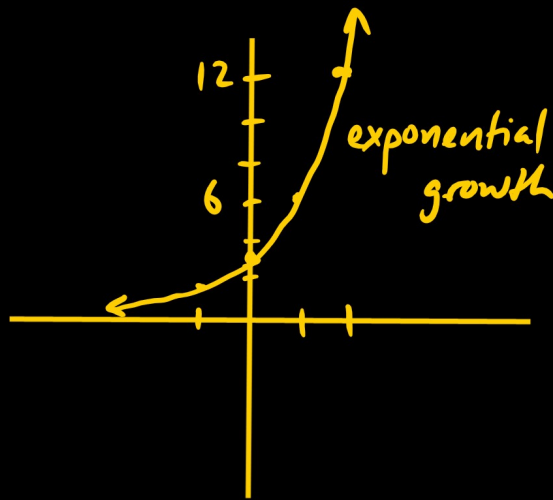
1) Calculate each of the following if  $f(x) = 3 \cdot 2^x$

a)  $f(2) = 3 \cdot 2^2 = 3 \cdot 4 = 12$

b)  $f(-1) = 3 \cdot 2^{-1} = 3 \cdot \frac{1}{2} = \frac{3}{2}$

2) Graph  $f(x) = 3 \cdot 2^x$

$x = -2, f(-2) = \frac{3}{4}$



## Section 1.2 Exponential Functions

Radioactive decay, compound interest and population growth are exponential functions.

$P = P_0 a^t$  is an exponential function.

$(a > 0, a \neq 1)$

$f(x) = 3 \cdot 1.05^x$

initial amount

growth rate is .05

$P_0$  is the initial quantity

If  $a > 1$  we have exponential growth - growth rate is  $a - 1$

$f(x) = 100 \cdot 0.75^t$

decay rate is  $1 - 0.75 = 0.25$

If  $0 < a < 1$  we have exponential decay. Decay rate is  $1 - a$ .

Alternate Form

$$P = P_0 e^{kt}$$

$k > 0$  for exponential growth

$k$  is the continuous growth rate

$e \approx 2.72$   
Euler

$$Q = Q_0 e^{-kt}$$

$k > 0$  for exponential decay

$k$  is the continuous decay rate

$$e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$$

ex:  $Q = 2e^{-0.5t}$

decay

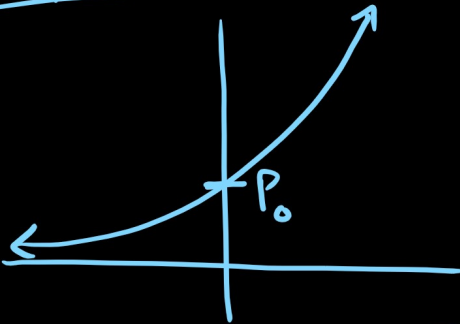
continuous decay rate = 0.5

$$\Rightarrow Q = Q_0 a^t = 2 \cdot 0.61^t$$

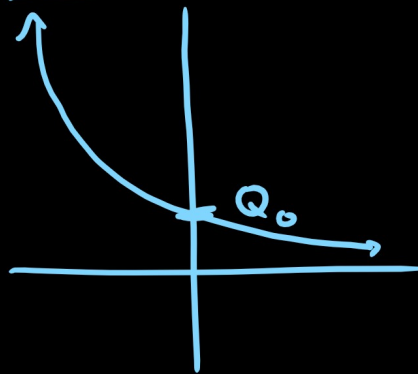
$$a = e^{-0.5}$$

$$e^{-0.5}$$

Exponential Growth



Exponential Decay

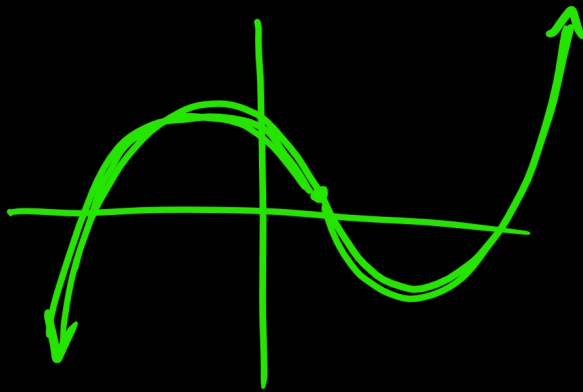


These graphs are

concave up - bends upward

concave down - bends downward

A small hand-drawn graph on a coordinate system. A curve starts at a point on the y-axis and decreases as it moves to the right, curving downwards. The curve is concave down.



#10 p15  $t, Q$   
 $(0, 30)$

a)  $m = -2$   
 2 grams per day

$t$	$Q$
0	30 ← $b = 30$
1	28
2	26

$$y = -2x + 30$$

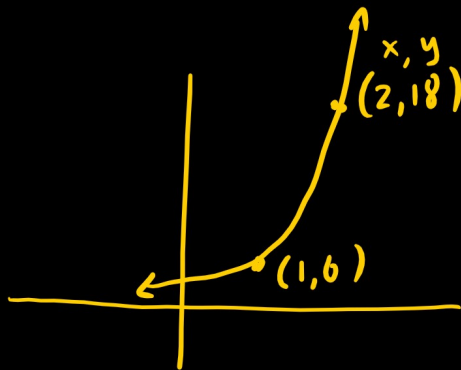
b) 12% per day

↑  
 decay rate

$$Q = 30 \cdot \underbrace{0.88}_\text{.12 decay rate}^t$$

$t$	$Q$
0	30
1	26.4
2	23.232

#20 p15



$$y = y_0 a^x$$

$$18 = y_0 a^2$$

$$3(6 = y_0 a^1)$$

$$18 = 3y_0 a$$

$$\frac{18}{6} = \frac{y_0 a^2}{y_0 a^1}$$

$$3 = a$$

$$\cancel{y_0} a^2 = 3 y_0 a$$

$$a^2 = 3a$$

$$\frac{6}{3} = \frac{y_0 \cdot 3^1}{3}$$

$$y_0 = 2$$

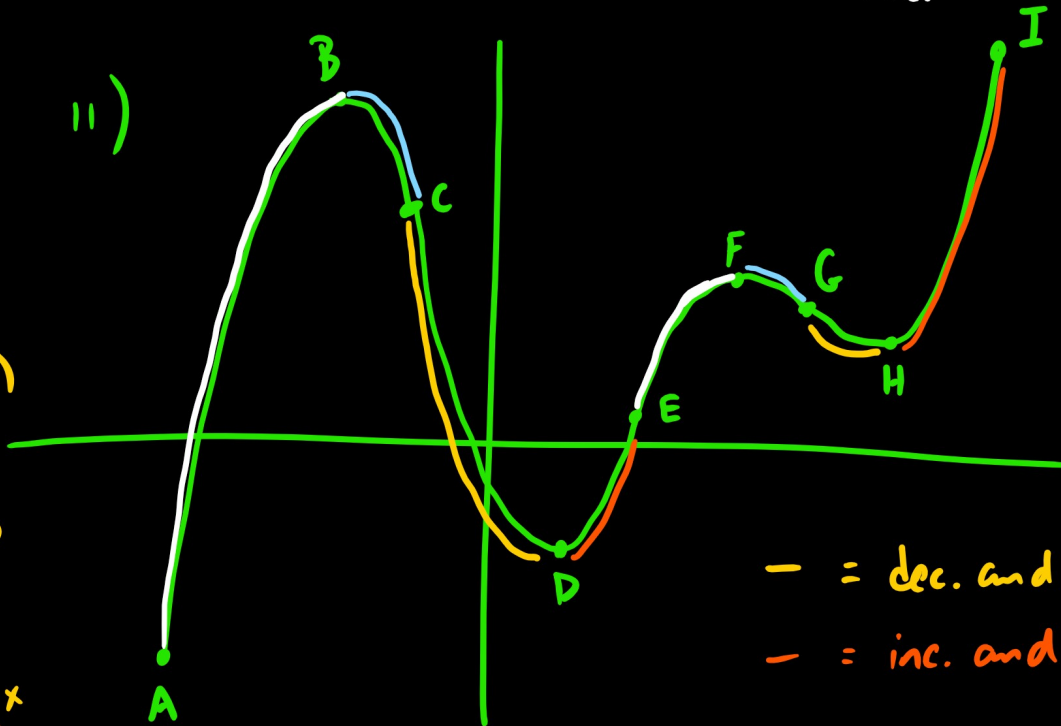
$$y = 2 \cdot 3^x$$

p 14-16 1-5, 11, 18, 19, 33

— = dec. and conc. down  
 — = inc. and conc. down

11)

18)  
 (0, 3)  
 (2, 12)  
 $y = y_0 a^x$   
 $3 = y_0 a^0$   
 $3 = y_0$   
 $y = 3 \cdot a^x$   
 $12 = 3 \cdot a^2$



$$y = 3 \cdot 2^x$$

— = dec. and conc. up  
 — = inc. and conc. up

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

19)  $(-1, 8)$   
 $(1, 2) \leftarrow$

$$y = y_0 \cdot \left(\frac{1}{2}\right)^x$$

$$2 = y_0 \cdot \left(\frac{1}{2}\right)^1$$

$$2 \cdot 2 = y_0 \cdot \frac{1}{2} \cdot 2$$

$$4 = y_0 \quad y = 4 \cdot \left(\frac{1}{2}\right)^x$$

$$y = y_0 \cdot a^x$$
$$\frac{2}{8} = \frac{y_0 a^1}{y_0 a^{-1}}$$

$$\sqrt{\frac{1}{4}} = \sqrt{a^2}$$

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