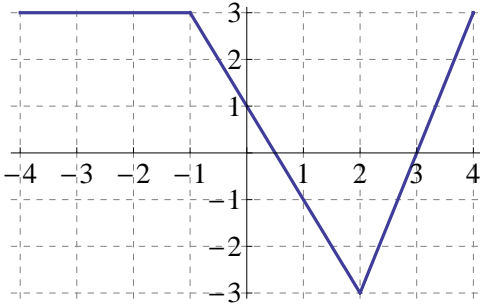


solution to quiz 3

1. [14 points] Given below is a graph of a function $f(x)$ and a table for a function $g(x)$.
Given answers for the following or write "Does not exist". Each problem is worth 2 points.



x	-3	-2	-1	0	1	2	3
$g(x)$	-2	-3	-2	-1	1	3	2
$g'(x)$	-2	0	1	3	2	0.5	-1

- a) $h(x) = \frac{g(x)}{f(x)}$. Find $h'(-3)$.

Solution: $h'(x) = \frac{g'(x)f(x) - g(x)f'(x)}{(f(x))^2}$, so

$$h'(-3) = \frac{g'(-3)f(-3) - g(-3)f'(-3)}{(f(-3))^2} = \frac{-2 \cdot 3 - (-2) \cdot 0}{3^2} = -2/3$$

- b) $k(x) = 3f(x) - g(x)$. Find $k'(2)$

Solution: $k'(x) = 3f'(x) - g'(x)$, so $k'(2) = 3f'(2) - g'(2)$. Since $f'(2)$ doesn't exist, $k'(2)$ doesn't exist.

- c) $q(x) = f(x)g(x)$. Find $q'(-2)$

Solution: $q'(x) = f'(x)g(x) + f(x)g'(x)$, so $q'(-2) = f'(-2)g(-2) + f(-2)g'(-2) = 0 \cdot (-3) + 3 \cdot 0 = 0$

- d) $a(x) = g(-f(x))$. Find $a'(1)$

Solution: $a'(x) = g'(-f(x))(-f'(x))$, so $a'(1) = g'(-f(1))(-f'(1)) = g'(1) \cdot 2 = 2 \cdot 2 = 4$

- e) $l(x) = e^{2f(x)}$. Find $l'(3)$

Solution: $l'(x) = e^{2f(x)} \cdot 2f'(x)$, so $l'(3) = e^{2f(3)} \cdot 2f'(3) = e^{2 \cdot 0} \cdot 2 \cdot 3 = 6$

- f) $p(x) = \sin(\frac{\pi}{f(x)})$. Find $p'(1)$

Solution: $p'(x) = \cos(\frac{\pi}{f(x)}) \cdot (-\pi \cdot (f(x))^{-2} \cdot f'(x))$, so $p'(1) = \cos(\frac{\pi}{f(1)}) \cdot (-\pi \cdot (f(1))^{-2} \cdot f'(1)) = \cos(-\pi) \cdot (-\pi) \cdot (-1)^{-2} \cdot (-2) = -2\pi$

- g) $t(x) = \ln((e^{g(x)})^2)$. Find $t'(-2)$

Solution: $t(x) = \ln((e^{g(x)})^2) = 2 \ln(e^{g(x)}) = 2g(x)$, so $t'(x) = 2g'(x)$. $t'(-2) = 2g'(-2) = 2 \cdot 0 = 0$

2. [6 points] “Winning the war on poverty” has been described cynically as slowing the rate at which people are slipping below the poverty line. Let N be the number of people below the poverty line at time t , answer the following questions.

(1) If N is increasing at a faster and faster rate.

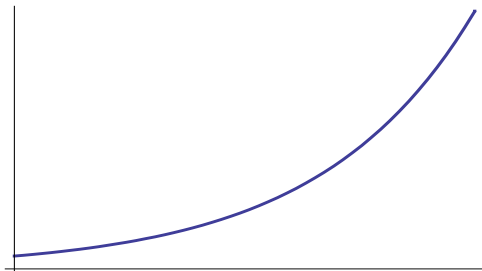
Is $N'(t)$ increasing, decreasing or neither? **Answer:** increasing

Which is a possible graph for N ? If none is possible, write None. **Answer:** a

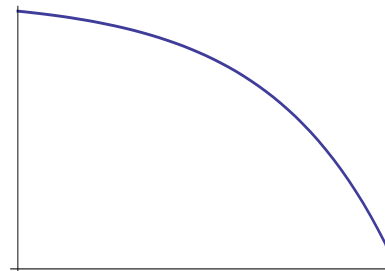
(1) If N is decreasing at a slower and slower rate.

Is $N'(t)$ increasing, decreasing or neither? **Answer:** increasing

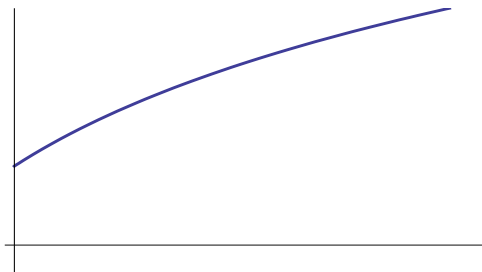
Which is a possible graph for N ? If none is possible, write None. **Answer:** d



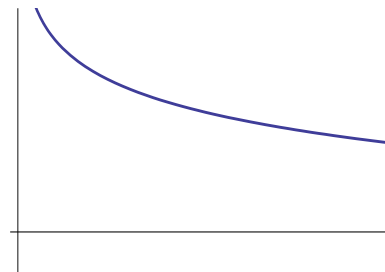
(a)



(b)



(c)



(d)