

Math 111
Exam 1 Answers

1. Slope of L is $\frac{1}{4}$ since it is perpendicular to a line with slope 4.

Note that the point $(8, -29)$ is on the line $8x + 2y = 6$. It is also on the line L since they intersect when $x = 8$.

Equations for the line L : $y + 29 = \frac{1}{4}(x - 8)$ or $y = \frac{1}{4}x - 31$

2. (a) $F(0) = 3$

(b) Solutions to $F(x) = 3$: $x = 0, x = 2, x = 4$

(c) Rate of change = $\frac{F(4) - F(1)}{4 - 1} = -\frac{1}{3}$

(d) Approximate Interval: $x > 2$

3. (a) Solving $-16t^2 + 72t = 0$ by factoring or using the quadratic formula: $t = 0, t = 4.5$

The ball lands at 4.5 seconds.

(b) Height at 2 seconds = $h(2) = 80$ feet

(c) Solving $-16t^2 + 72t = 32$ by factoring or using the quadratic formula: $t = \frac{1}{2} = 0.5, t = 4$

The ball is 32 feet high at 0.5 seconds and 4 seconds.

4. (a) $f(15) = 7 + 0.4(15) = 13 \Rightarrow$ In 2015, there are 13 thousand people in Springfield.

(b) To find $f^{-1}(15)$, you can find the inverse function by solving for t and evaluate it at 15

$$(f^{-1}(P) = \frac{P-7}{0.4} \Rightarrow f^{-1}(15) = 20)$$

OR you can let $P = 15$ and solve for t in the original formula ($15 = 7 + 0.4t \Rightarrow t = 20$).

Either way, you get that in 2020, the population was 15 thousand people.

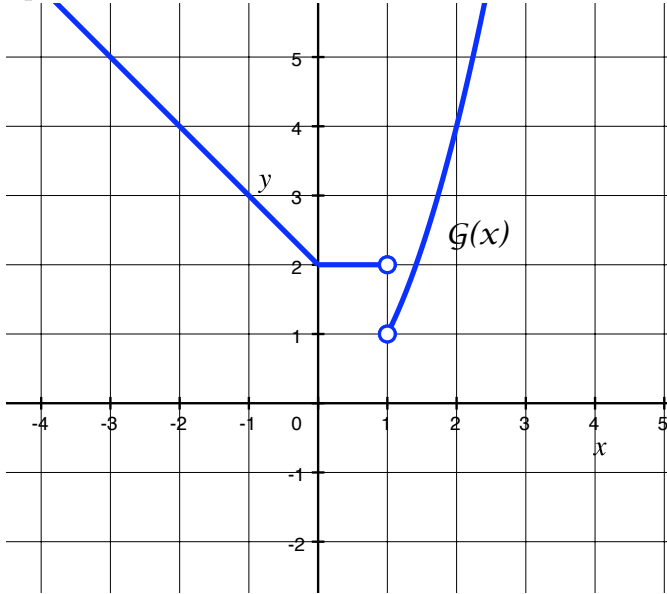
(c) The rate of change is the slope of the linear function, which is 0.4 for this population. The units are thousands of people/year.

5. (a) Since $f(4) = 6, g(f(4)) = g(6) = 7$

(b) $f(g(x)) = 1.5(\sqrt{x+3} + 4) = 1.5\sqrt{x+3} + 6$

(c) $x = g^{-1}(y) = y^2 - 6y + 7$ (Solving for x)

6. (a) For $x < 0$, we have a line of slope -1 with y -intercept $(0,2)$. For $0 \leq x < 1$, we have a horizontal line whose points have y -coordinate 2. For $x > 1$, we have a parabola that opens upward.



- (b) Domain: $x \neq 1$, Range: $y > 1$