Chapter 1 Homework Solutions

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1. (a) The two points are $(70, 120)$ and $(80, 160)$.

$$\text{slope} = \frac{160 - 120}{80 - 70} = 4.$$

Answer(either of these):
point-slope formula: $y - 120 = 4(x - 70)$
slope-intercept formula: $y = 4x - 160$

(b) Temperature is represented by the variable x, so plug $x = 102$ into the equation in part (a).

Answer: 248 chirps per minute

(c) x-intercept: set $y = 0$ in the equation in part (a) and solve for x.

x-intercept = 40; This could make sense. It says the chirp rate is 0 when the temperature is 40^oF.

y-intercept: set $x = 0$ in the equation in part (a) and solve for y.

y-intercept = -160; This doesn't make sense. It says there will be a negative number of chirps per minute when the temp is 0^oF.

2. (a) The points are $(24, 172)$ and $(26, 175)$.
$m = \dfrac{175 - 172}{26 - 24} = 1.5$
Answer(either of these):
point-slope formula: $y - 172 = 1.5(x - 24)$
slope-intercept formula: $y = 1.5x + 136$

(b) plug in $x = 20$ and get height is 166cm tall

(c) x-intercept: set $y = 0$ in the equation in part (a) and solve for x.

x-intercept = -90.6667; Doesn't make sense in that it gives a negative length for a bone.

y-intercept: set $x = 0$ in the equation in part (a) and solve for y.

y-intercept = 136; This does not really make sense since a radius bone of length 0 gives a height of 136cm.

3. The variable x is the age of the truck. So we have the points $(3, 20000)$ and $(8, 12600)$.

Answer(either of these):
point-slope formula: $y - 20000 = -1480(x - 3)$
slope-intercept formula: $y = -1480x + 24440$

4. The x variable is age. So we have the points, $(0, 14000)$ and $(10, 1000)$. Using these points we get the equation, $y = -1300x + 14000$. Finally we want the value of the vehicle after 5 years, so plug $x = 5$ into our equation.

Answer: \$7500

5. The points $(0, 50000)$ are $(9, 500)$.

(a) Answer(either of these):
point-slope formula: $y - 500 = -5500(x - 9)$
slope-intercept formula: $y = -5500x + 50000$

(b) The slope is -5500 and it means that the value is decreasing by \$5500 each year.

6. The points $(3, 85000)$ are $(11, 36000)$. Note: x is the age of the truck.

(a) Answer(either of these):
point-slope formula: $y - 85000 = -6125(x - 3)$
slope-intercept formula: $y = -6125x + 103375$

(b) The tractor was new when it's age was 0, so plug $x = 0$ into the equation.

Answer: \$103,375

(c) \$6125 per year. Note: by asking for the rate of depreciation you are wanting how much the value of the object is decreasing per year.

7. The two points, $(1980, 185)$ are $(1994, 220)$.
Answer(either of these):
point-slope formula: $y - 185 = 2.5(x - 0)$
slope-intercept formula:$y = 2.5x + 185$

8. The two points, $(4, 40000)$ are $(12, 15000)$.

(a) $y = -3125x + 52500$

(b) plug $x = 0$ into our equation.
Answer: \$52,500

(c) \$3125 per year. Note: by asking for the rate of depreciation you are wanting how much the value of the object is decreasing per year.

9. The two points, $(125, 35.75)$ are $(265, 51.15)$. Notice the points are in the form (miles, cost).

Answer: $y = 0.11x + 22$

10. The two common methods to solve are *substitution* and *elimination.*

(a) **Substitution Method**:
Step 1. Solve one of the equations for one of the variables. In this example it easiest to solve the first equation for the y variable.

$$y = 7x - 32$$

Step 2. Plug this variable into the other equation and solve for the remaining variable.

$$\begin{aligned} 2x + 3(7x - 32) &= 19 \\ 2x + 3(7x - 32) &= 19 \\ 2x + 21x - 96 &= 19 \\ 23x &= 115 \\ x &= 5 \end{aligned}$$

Step 3. Plug this answer into the original equation from step 1.

$$y = 7(5) - 32 = 3.$$

Answer: $x = 5$, $y = 3$

(b) **Elimination Method:**

Step 1. Multiply each equation by a number so that the coefficient in front of the variable x (or possible y) are the same except for their sign. For this problem multiply the top equation by -2 and the bottom equation by 3.

$$\begin{aligned} -6x + 8y &= -44 \\ 6x + 15y &= 21 \end{aligned}$$

Step 2. Add the equations together and then solve for the remaining variable.

$$\begin{aligned} 23y &= -23 \\ y &= -1 \end{aligned}$$

Step 3: Plug in the value of the variable into any of the equations.

$$\begin{aligned} 3x - 4(-1) &= 22 \\ 3x + 4 &= 22 \\ 3x &= 18 \\ x &= 6 \end{aligned}$$

Answer: $x = 6$, $y = -1$

(c) No solution.
If you ever get something that doesn't make sense (like $1 = 0$ or something) then there is no solution.

(d) $x = \frac{18}{11}$, $y = \frac{-17}{11}$

(e) $x = \frac{9}{7}$, $y = \frac{-10}{7}$

11. Break even means that cost and revenue are the same, so we need to solve $C = R$.

$$15x + 12000 = 21x.$$

Once we've found x, plug this into either equation (or both to check our answer) to find the rest of the point.

Answer: $(2000, 42000)$

12. (a) $R = 0.25x$ since each scantron is sold for \$0.25.

(b) The cost function is $C = vc * x + fc$ where vc is the variable cost, i.e. cost per item, and fc is the fixed cost. From the problem we know $vc = 0.15$. We also know that when 6500 units are sold the store breaks even, so when $x = 6500$ we have Cost = Revenue, so we have to solve

$$\begin{aligned} 0.25(6500) &= 0.15(6500) + fc \\ fc &= 650. \end{aligned}$$

Answer: $C = 0.15x + 650$

(c) $P = R - C = 0.25x - (.15x + 650) = 0.1x - 650$

13. The cost function is $C = vc * x + fc$ where vc is the variable cost, i.e. cost per item, and fc is the fixed cost. From the problem we know that $vc = 5$ and that when $x = 20$ then $C = 500$. Use this to solve for the fixed cost.

$$\begin{aligned} 500 &= 5 * 20 + fc \\ 400 &= fc \end{aligned}$$

Thus $C = 5x + 400$.

From the problem we know that when $x = 30$ then the profit is 290. Also, Profit=Revenu-Cost and the revenue function is $R = A * x$ where A is the price that each item is sold.

$$\begin{aligned} P &= A * x - (5x + 400) \\ 290 &= A * 30 - (5 * 30 + 400) \\ 290 &= 30A - 550 \\ 840 &= 30A \\ A &= 28 \end{aligned}$$

Thus $R = 28x$

14. (a) The cost function is $C = 0.75x + 45$ here x is the number of questions he answers. Revenue is $R = Ax$ where A is the selling price per item. Also, Profit = Revenue - Cost. From the problem we know that when $x = 40$ then $P = 15$. So we need to solve the following:

$$\begin{aligned} 15 &= A * 40 - (.75 * 40 + 45) \\ 15 &= 40A - 75 \\ 90 &= 40A \\ A &= 2.25 \end{aligned}$$

Answer: \$2.25

(b) Break even is when Revenue = Cost, so we must solve

$$2.25x = .75x + 45$$

Answer: 30 questions.

15. general formulas are R=A*x and C = vc*x + fc
A = selling price per item
vc = cost per item
fc = fixed cost of the business

The problem tells us that fc = 600 (monthly rent).
When $x = 60$ then the cost is 1680 so solve for the variable cost.

$$\begin{aligned} 1680 &= \text{vc} \cdot 60 + 600 \\ \text{vc} &= 18 \end{aligned}$$

Revenue = Cost when 40 cds are sold.

$$\begin{aligned} A \cdot 40 &= 18 \cdot 40 + 600 \\ A &= 33 \end{aligned}$$

Answers:$R = 33x$
$C = 18x + 600$
$P = 15x - 600$

16. (a) $P = R - C = 500x - (240x + 2405) = 260x - 2405$
    (b) When your solve for x when $P = 0$ or $R = C$, you get $x = 9.25$. This is thousand of cups sold. Multiply by 1000 to get the number of cups sold.
    Answer: 9250 cups of lemonade.
    (c) Plug in $x = 9.25$ into the revenue function.
    Answer: \$4625.

17. Use the points $(10, 159)$ and $(40, 99)$. Remember that the points are of the form (x,p) where x = quantity and p = price.
    Answer: $p-159 = -2(x-10)$ or simplified to $p = -2x+179$

18. (a) The two points are $(700, 580)$ and $(1300, 940)$. The points are taken from the supply information.
    Answer: $p = 0.6x + 160$
    (b) The two point are $(2000, 400)$ and $(1500, 500)$. The points are taken from the demand information.
    Answer: $p = -0.2x + 800$
    (c) Since both equations (in part a and b) are set equal to p, then you can set the equations and solve for x.
    Answer: $(800, 640)$

19. Use a method shown in problem 10 to solve the system of equations. Note: The chapter 2 material will make solving this type of problem easier.
    Equilibrium quantity is 6580 items.
    Equilibrium price is \$424.

20. (a) Note: The problem specifies that the value of x is the number of rackets and p is price in dollars. The two points are $(8000, 120)$ and $(3000, 230)$.
    Answer: $p = -0.022x + 296$
    (b) Solve the supply and demand equations simultaneously using a method outlined in problem 10. This answer will be the x value.
    Answer: 4400 rackets
    (c) The p value from part (b).
    Answer: \$199.20

21. (a) x is in thousands of units so our points are $(3, 31)$ and $(8, 16)$.
    Answer: $3x + p = 40$
    (b) Solve the supply and demand equations simultaneously using a method outlined in problem 10. The answer will be 1000 times the x value.
    Answer: 6000 markers
    (c) The p value from part (b).
    Answer: \$22

22. (a) The two points are $(0, 1.5)$ and $(600, 3)$.
    Answer: $p = .0025x + 1.5$
    (b) Solve the supply and demand equations simultaneously using a method outlined in problem 10. This answer will be the x value.
    Answer: $x = 200$