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MATH 021 – Exam 1 – Practice Exam Solutions

Problem #1

$Thickness\ of\ \$1\ bill = 4.3 \times 10^{-3}$
$10\ thousand\ bills = 1 \times 10^{4}$

$(4.3 \times 10^{-3}) \times (1 \times 10^{4}) = 4.3 \times 10^{1} = 43\ inches$

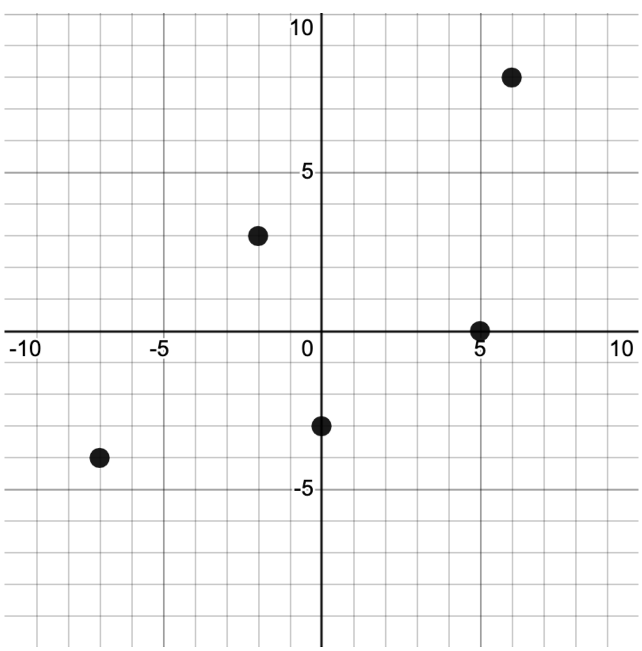
Problem #2

a. $\%\ Change = \frac{80-100}{100} \times 100\% = -20\%$

b. $\%\ Change = \frac{100-80}{80} \times 100\% = 25\%$

Problem #3

$D = \{-7, -2, 0, 5, 6\}$
$R = \{-4, -3, 0, 3, 8\}$



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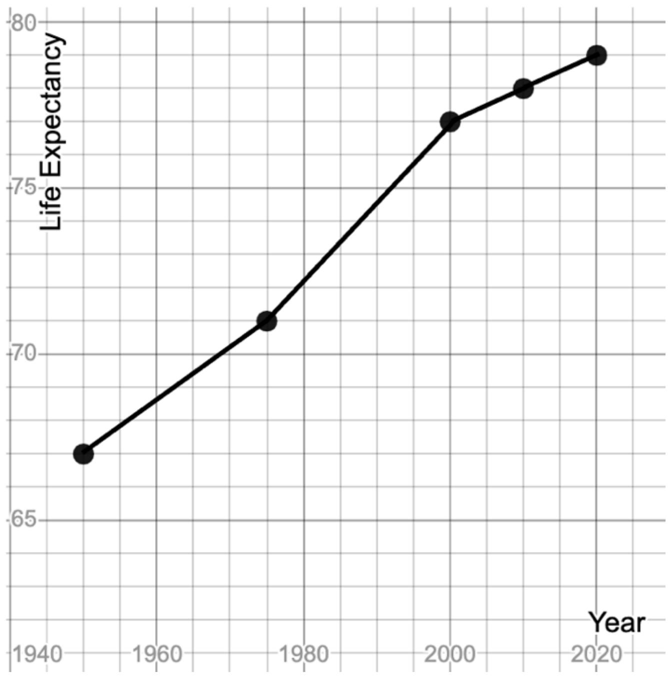
Problem #4

a. Maximum: (2020, 79)
   Minimum: (1950, 67)

b.



c. $Midpoint = \left(\frac{2010+2020}{2}, \frac{78+79}{2}\right) = (2015, 78.5\,)$

Problem #5

a. $Center = Midpoint\ of\ Diameter = \left(\frac{2+(-4)}{2}, \frac{-7+1}{2}\right) = (-1, -3)$

$Radius = Disance\ from\ Center\ to\ Endpoint = \sqrt{\left(-4-(-1)\right)^2 + \left(1-(-3)\right)^2}$

$= \sqrt{25} = 5$

b. $(x+1)^2 + (y+3)^2 = 25$

c. $(x+1)^2 + (y+3)^2 = 25$
   $(x+1)(x+1) + (y+3)(y+3) = 25$
   $x^2 + 2x + 1 + y^2 + 6y + 9 = 25$
   $x^2 + 2x + y^2 + 6y = 15$

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Problem #6

Subtract 89 from both sides:

$$16x^2 + 24x + 16y^2 - 96y = -89$$

Divide both sides by 16:

$$x^2 + \frac{3}{2}x + y^2 - 6y = -\frac{89}{16}$$

Divide coefficients of x and y by 2:

$$\frac{3}{2} \div 2 = \frac{3}{4}$$

$$-\frac{6}{2} = -3$$

Square your answers:

$$\left(\frac{3}{4}\right)^2 = \frac{9}{16}$$

$$-3^2 = 9$$

Add your answers to both sides of the equation to complete the squares:

$$x^2 + \frac{3}{2}x + \frac{9}{16} + y^2 - 6y + 9 = -\frac{89}{16} + \frac{9}{16} + 9$$

Factor out the binomial:

$$\left(x + \tfrac{3}{4}\right)^2 + (y - 3)^2 = 4$$

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Problem #7

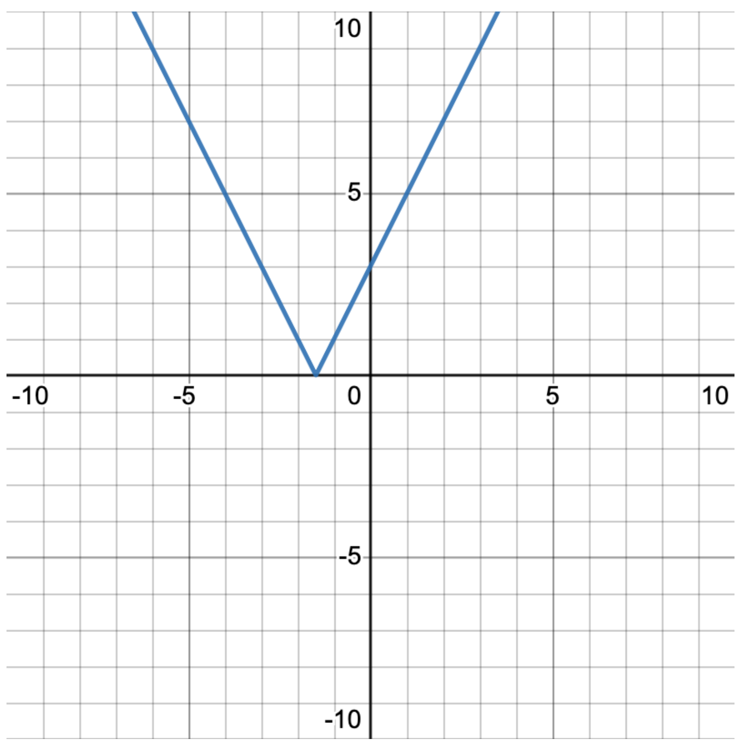
a. $D = (-\infty, \infty)$

b. Multiply the input by –2, subtract 3, and then find the absolute value to get g(x).

c.

x	g(x)
–3	3
–1	1
0	3
1	5
3	9

d. $R = [0, \infty)$



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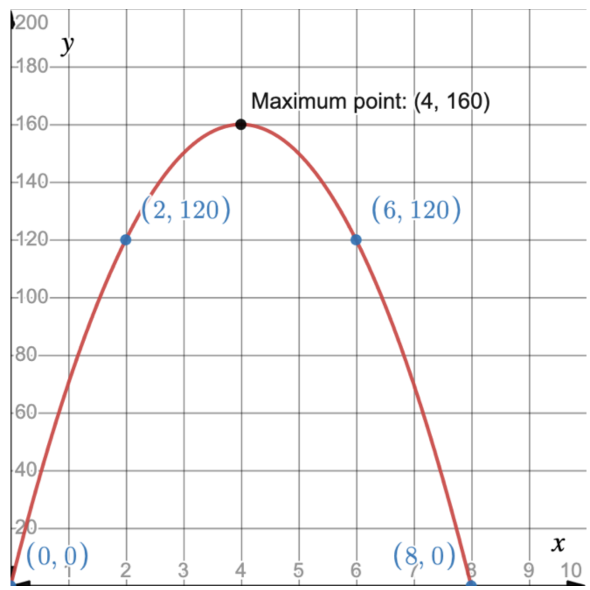
Problem #8

a. $h(0) = 80(0) - 10(0)^2 = 0$
$h(5) = 80(8) - 10(8)^2 = 0$

After 0 seconds (the moment when the rocket launches) and after 8 seconds, the rocket will be on the ground.

b. $D: [0,8]$

c. Increasing: (0,4)
Decreasing: (4,8)



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Problem #9

a. x-intercepts: (-1, 0), (2.5, 0)
   y-intercept: (0, 1)

b. Positive: [-5, -1), (-1, 2.5)
   Negative: (2.5, 4]

c. Average rate of change:

   i. $\frac{0-4}{-1-(-4)} = -\frac{4}{3}$ decreasing

   ii. $\frac{1-0}{1-(-1)} = \frac{1}{2}$ increasing

   iii. $\frac{1-1}{2-1} = 0$ constant

   iv. $\frac{-3-1}{4-2} = -2$ decreasing

Problem #10

$f(x) = x^2 + 2x - 4$

$f(x+h) = (x+h)^2 + 2(x+h) - 4$
$f(x+h) = x^2 + 2xh + h^2 + 2x + 2h - 4$

$$Difference\ quotient = \frac{x^2 + 2xh + h^2 + 2x + 2h - 4 - (x^2 + 2x - 4)}{h}$$

$$= \frac{x^2 + 2xh + h^2 + 2x + 2h - 4 - x^2 - 2x + 4}{h}$$

$$= \frac{2xh + h^2 + 2h}{h}$$

$$= 2x + h + 2$$

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Problem #11

a. $p(1) = 1^2 + 5(1) = 6$

1 day after a rumor begins, approximately 6% of the town has heard some version of the rumor.

b. $p(t) = t^2 + 5t$

$p(t + h) = (t + h)^2 + 5(t + h)$
$p(t + h) = t^2 + 2th + h^2 + 5t + 5h$

$$Difference\ quotient = \frac{t^2 + 2th + h^2 + 5t + 5h - (t^2 + 5t)}{h}$$

$$= \frac{t^2 + 2th + h^2 + 5t + 5h - t^2 - 5t}{h}$$

$$= \frac{2th + h^2 + 5h}{h}$$

$$= 2t + h + 5$$

c. $2(2) + (0.1) + 5 = 9.1$

During the time period from 2 days to 2.1 days after the rumor begins, the percentage of the town that has heard the rumor increases by an average of approximately 9.1% per day.

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