MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

TEST 1 **Math 1090** FALL 2009

SOLUTIONS

[3] 1. (a) $(-\infty, -4] \cup [0, 3)$

[3] (b) A function assigns to each x in its domain a *unique* value $f(x)$. This means that two points cannot each have the same x-coordinate, but different y-coordinates. Thus the points

$$(-1, 1), (0, 2), (1, 2), (1, 3), (2, 3)$$

cannot lie on a curve which represent the graph of a function, because this would imply that $f(1) = 2$ and $f(1) = 3$ simultaneously.

[3] (c) Note that $-2 = \dfrac{-2}{1}$ so -2 belongs to $\mathbb{R}$, $\mathbb{Q}$ and $\mathbb{Z}$.

[3] (d) $-3 \cdot |3 - 7| = -3 \cdot |-4| = -3 \cdot 4 = -12$

[3] (e) The graph of a linear function is always a line, but not a horizontal line (which is the graph of a constant function) nor a vertical line (which is not the graph of a function). Hence a linear function always has exactly one x-intercept, and exactly one y-intercept.

[5] 2. We have

$$\begin{aligned} \frac{1}{6}x - 4 &= 3 - \frac{2}{9}x \\ \frac{1}{6}x + \frac{2}{9}x &= 3 + 4 \\ \frac{3}{18}x + \frac{4}{18}x &= 7 \\ \frac{7}{18}x &= 7 \\ x &= 18. \end{aligned}$$

The only solution is $x = 18$.

[5] 3. We have

$$\begin{aligned} 5x &\leq 5 - 2(7 - 4x) \\ 5x &\leq 5 - 14 + 8x \\ 14 - 5 &\leq 8x - 5x \\ 9 &\leq 3x \\ 3 &\leq x. \end{aligned}$$

As an interval, this solution is given by $[3, \infty)$.

[3] 4. We define $|x|$ as

$$|x| = \begin{cases} x & \text{for } x \geq 0 \\ -x & \text{for } x < 0 \end{cases}.$$

[6] 5. First we need to find the slope of the given line ℓ. We rewrite it in slope-intercept form by solving for y, giving

$$\begin{aligned} 3x + 4y + 5 &= 0 \\ 4y &= -3x - 5 \\ y &= -\frac{3}{4}x - \frac{5}{4}. \end{aligned}$$

From this we see that the slope of ℓ is $-\frac{3}{4}$. Thus the slope of any line perpendicular to this line must be

$$m = -\frac{1}{-\frac{3}{4}} = \frac{4}{3}.$$

The desired line must have equation

$$\begin{aligned} y &= \frac{4}{3}x + b \\ -2 &= \frac{4}{3} \cdot 3 + b \\ -2 &= 4 + b \\ -6 &= b \end{aligned}$$

so the equation of this line is

$$y = \frac{4}{3}x - 6.$$

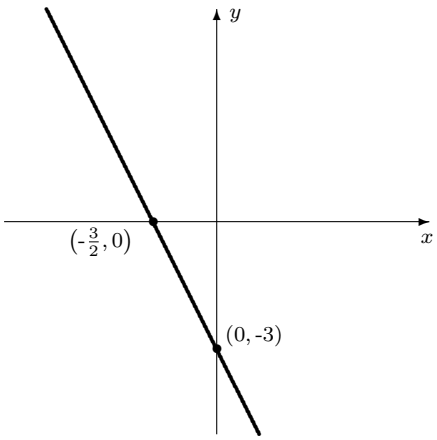
[6] 6. This is a linear function, so we know its graph is a line. First we find the x-intercept. We set

$$\begin{aligned} -3 - 2x &= 0 \\ -2x &= 3 \\ x &= -\frac{3}{2} \end{aligned}$$

so the x-intercept is the point $\left(-\frac{3}{2}, 0\right)$. Next, observe that

$$f(0) = -3 - 2 \cdot 0 = -3,$$

so the y-intercept is the point $(0, -3)$. Now we can plot these points and sketch the graph.



Since the function is linear, its domain is $D = \mathbb{R}$ and its range is $R = \mathbb{R}$.