Math 105: Calculus with Algebra
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quiz archive

Gradescope code: B5J8EN

Math 105 Fall 2026 - Take-Home Quiz 1 Solutions
Due Sunday 9/6/2026 - at 11:55 PM

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(1) Solve the equation $|x-2| = 7$ for x.

Solution. Since $|x-2| = 7$, either $x-2 = 7$ or $x-2 = -7$. Thus $x = 9$ or $x = -5$.

(2) Solve the inequality $|x+3| < 4$.

Solution. The inequality $|x+3| < 4$ is equivalent to $-4 < x+3 < 4$. Subtracting 3 throughout gives $-7 < x < 1$.

Thus the solution is $(-7, 1)$. On the number line, shade the interval between -7 and 1, with open circles at -7 and 1.

(3) Express

$$1 + \frac{1}{\frac{x}{x+2}}$$

as a single fraction.

Solution. We have

$$1 + \frac{1}{\frac{x}{x+2}} = 1 + \frac{x+2}{x} = \frac{x+x+2}{x} = \frac{2x+2}{x}.$$

Thus the single fraction is $\dfrac{2x+2}{x}$.
The original expression is defined only when $x \neq -2$ and $x \neq 0$.

(1) Consider the line

$$x + 2y = 2.$$

(a) To find the slope, solve the equation for y:

$$x + 2y = 2$$

$$2y = -x + 2$$

$$y = -\frac{1}{2}x + 1.$$

Thus the slope is

$$\boxed{-\frac{1}{2}}.$$

(b) A line parallel to this line has the same slope, so its slope is $-\frac{1}{2}$. Since it passes through $(2, -1)$, we can use point-slope form:

$$y - (-1) = -\frac{1}{2}(x - 2).$$

Thus

$$y + 1 = -\frac{1}{2}x + 1,$$

and hence

$$\boxed{y = -\frac{1}{2}x}.$$

(c) A perpendicular line has slope equal to the negative reciprocal of the original slope. Since the original slope is $-\frac{1}{2}$, the perpendicular slope is

$$\boxed{2}.$$

(2) Let

$$f(x) = 3x^2 + 2.$$

We want to compute

$$\frac{f(a+h) - f(a)}{h}.$$

First,

$$f(a+h) = 3(a+h)^2 + 2.$$

Expanding gives

$$f(a+h) = 3(a^2 + 2ah + h^2) + 2 = 3a^2 + 6ah + 3h^2 + 2.$$

Also,

$$f(a) = 3a^2 + 2.$$

Therefore

$$\begin{aligned}\frac{f(a+h) - f(a)}{h} &= \frac{3a^2 + 6ah + 3h^2 + 2 - (3a^2 + 2)}{h} \\ &= \frac{6ah + 3h^2}{h} \\ &= \boxed{6a + 3h}.\end{aligned}$$

(3) Let

$$g(x) = \begin{cases} x^2, & \text{if } x \leq 4, \\ -|x - 4|, & \text{if } x > 4. \end{cases}$$

(a) To compute $g(0)$, notice that $0 \leq 4$, so we use the first part of the definition:

$$g(0) = 0^2 = \boxed{0}.$$

Since $5 > 4$, we use the second part to compute $g(5)$:

$$g(5) = -|5-4| = -|1| = \boxed{-1}.$$

(b) For $x \leq 4$, the graph is the parabola

$$y = x^2.$$

Since $x = 4$ is included, there is a closed point at

$$(4, 16).$$

For $x > 4$, we have $x - 4 > 0$, so

$$|x-4| = x - 4.$$

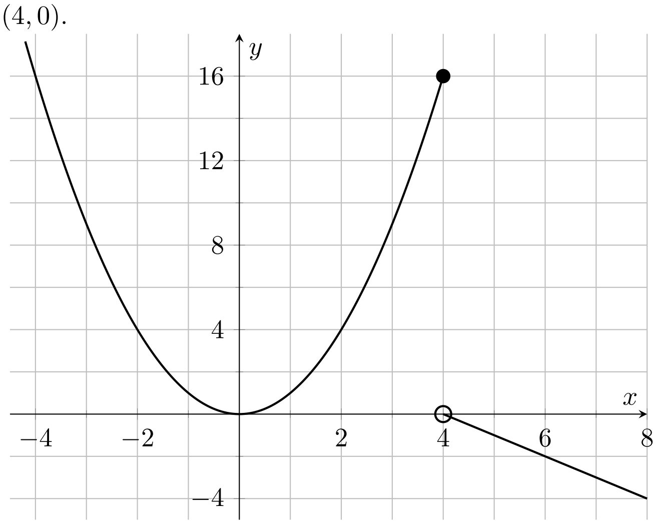
Therefore

$$-|x-4| = -(x-4) = 4 - x.$$

Thus the second piece is the line

$$y = 4 - x, \qquad x > 4,$$

with an open point at $(4, 0)$.



The first piece covers all $x \leq 4$ and the second covers all $x > 4$. Therefore the domain is

$$\boxed{(-\infty, \infty)}.$$

The parabola gives every $y \geq 0$, while the line gives every $y < 0$. Together these give every real number. Therefore the range is

$$\boxed{(-\infty, \infty)}.$$