SOLUTIONS

BRONX COMMUNITY COLLEGE

of the City University of New York

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

MTH 30 — Exam 2
Kerry Ojakian — FALL 2025
YOUR NAME (first, then last):

Directions: Write your responses in the provided space. To get full credit you **must** show all your work. Simplify your answers whenever possible. Be certain to indicate your final answer clearly. **No** electronic devices are allowed (i.e. no calculators, no phones, no smart watches, etc) - using one during the exam will result in at least a failure on this test. Each question is worth 10 points.

1. Solve.

   (a) $|3x - 2| = 14$.

   (b) $|42x + 7| = -3$

   SOLUTION:
   For (a) we solve the following 2 equations

$$\begin{aligned} 3x - 2 &= 14 \\ 3x &= 16 \\ x &= \frac{16}{3} \end{aligned}$$

$$\begin{aligned} 3x - 2 &= -14 \\ 3x &= -12 \\ x &= -4 \end{aligned}$$

   So for (a), the answer is $x = \frac{16}{3}, \quad -4$.

   For (b): It has No Solution. Since absolute value cannot equal negative.

---

2. Solve.

(a) $|3x-5| \leq 13$

(b) $|x+10| \geq 2$

SOLUTION:
For (a)

$$\begin{array}{rcccl} -13 & \leq & 3x-5 & \leq & 13 \\ -8 & \leq & 3x & \leq & 18 \\ \frac{-8}{3} & \leq & x & \leq & 6 \end{array}$$

For (b)
Get two inequalities: Either $x+10 \leq -2$ or $x+10 \geq 2$. Solve each to get answer: $x \leq -12$ or $x \geq -8$.

---

3. Determine the end behavior of the functions.

(a) $h(x) = 10x^3$

(b) $f(x) = -5x^4$

SOLUTION:
As $x \to +\infty$, $h(x) \to +\infty$ (by test value: $h(1) = 10 > 0$)
As $x \to -\infty$, $h(x) \to -\infty$ (by test value: $h(-1) = -10 < 0$)
As $x \to +\infty$, $f(x) \to -\infty$ (since exponent even and coefficient negative)
As $x \to -\infty$, $f(x) \to -\infty$ (since exponent even and coefficient negative)

---

4. For each pair of functions, check if they are inverses by checking if both $f(g(x)) = x$ and $g(f(x)) = x$.

(a) $f(x) = \dfrac{x}{2} + 1,\ g(x) = 2(x-1)$

(b) $f(x) = 9x+1,\ g(x) = -9x-1$

SOLUTION:
For (a).

$$\begin{array}{rcl} f(g(x)) & = & \dfrac{2(x-1)}{2} + 1 \\ & = & x-1+1 \\ & = & x \end{array}$$

$$\begin{array}{rcl} g(f(x)) & = & 2\left((\dfrac{x}{2}+1)-1\right) \\ & = & 2\left(\dfrac{x}{2}\right) \\ & = & x \end{array}$$

Therefore they **are** inverses.

For (b).

$$\begin{array}{rcl} f(g(x)) & = & 9(-9x-1)+1 \\ & = & -81x-9+1 \\ & = & -81x-8 \\ & \neq & x \end{array}$$

Therefore they are **not** inverses (could also see this by trying $g(f(x))$ instead).

---

5. Find the inverse of the function $f(x) = 2x - 1$.

SOLUTION:
We need to solve $f(y) = x$ for y, i.e. solve $2y - 1 = x$ for y.

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

Therefore the inverse of f is $f^{-1}(x) = \frac{x+1}{2}$ (or, if you prefer, $f^{-1}(y) = \frac{y+1}{2}$).

---

6. Consider the linear function $f(x) = -3x + 2$. Find its slope and all its intercepts. Then graph f.
SOLUTION:
It is in $mx + b$ form with $m = -3$ and $b = 2$, so:
Slope is -3
y-intercept is 2.
For x-intercepts: Solve $-3x + 2 = 0$. Subtract 2 to get $-3x = -2$, then divide by -3 to get $x = \frac{2}{3}$.
Graph:

---

7. Find the point of intersection between the lines, if it exists:
$f(x) = \frac{2}{3}x - 2$ and $g(x) = -\frac{1}{3}x + 1$.
SOLUTION:

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

To find y, use either equation, say: $y = \frac{2}{3}(3) - 2 = 0$, thus the point of intersection is $(3, 0)$.

---

8. Consider the linear equation $f(x) = 3x - 1$.

(a) Write the equation for a line parallel to $f(x)$ and passing through the point $(-2, 7)$.

(b) Write the equation for a line perpendicular to $f(x)$ and passing through the point $(0, -5)$.

SOLUTION:

(a) To be parallel, the slope is 3. Using the point $(-2, 7)$ and the point-slope form of the line we get: $y = 7+3(x-(-2))$ which simplifies to $y = 7+3(x+2)$ or even $y = 3x+13$

(b) To be perpendicular, the slope is $-\frac{1}{3}$. Using the point $(0, -5)$ and the point-slope form of the line we get: $y = -5 + -\frac{1}{3}(x - 0)$ which simplifies to $y = -\frac{1}{3}x - 5$

---

9. What is the domain and range of the quadratic function $g(x) = x^2 + 6x + 4$.
SOLUTION:
Domain: All reals.

Range: First find the x coordinate of the vertex, from the axis of symmetry (from $x = \dfrac{-b}{2a}$), that is: $x = \dfrac{-6}{2(1)}$, so $x = -3$.
To find the y coordinate of the vertex: $g(-3) = 9 - 18 + 4 = -5$, so the vertex is $(-3, -5)$.
Since this parabola opens up, the range is: All reals $y \geq -5$.

---

10. The amount of money in dollars (M) in the school's bank account t days after it opens is modeled by $M(t) = 2t^2 - 20t + 85$.

(a) How many days after the school opens is the bank account's minimum reached?

(b) What is that minimum amount of money in the bank account?

SOLUTION:
This parabola opens up, so has a minimum at its vertex.

For (a): Find the axis of symmetry ($t = \dfrac{-b}{2a}$), so $t = \dfrac{-(-20)}{2(2)}$, so $t = 5$. So the minimum occurs when $t = 5$, so after 5 days.

For (b): Find the y coordinate of the vertex, by $M(5) = 50 - 100 + 85 = 35$, so the minimum amount of money is \$35.
