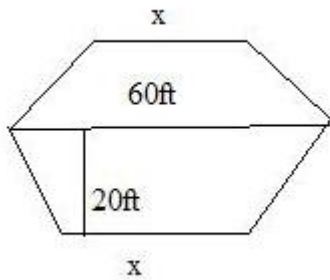


Math 120-001
(MTWR 11:15-12:10)
Timothy Zick
Quiz #2A

Name: _____

Directions: Follow all directions carefully. Show all work (where applicable). Problems without work may not receive full credit. The quadratic formula is something that you will need to have memorized. For now, I will give it to you but will not tell you how to use it. The quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. In problem 1 (a) label the sides that run parallel to the tight rope as x . The total number of points on this quiz is 25.

1. Recall that the area of a trapezoid is given by $\frac{1}{2}h(a + b)$ where h is the height of the trapezoid, and a and b are the lengths of the parallel sides. A hexagon-shaped circus tent has a 60 foot long tight rope from one of the corners to another, cutting the tent into two equally-sized trapezoids. The rope is 20 feet from the outer edges of the tent (to allow the tight rope walker enough room to have his long balance stick). The area of the tent floor is 2000 square feet. Do the following:
 - (a) (2 points) Draw the tent as viewed from above with the tight rope and any lengths given in the problem properly labeled. Bring this drawing up to me so I can verify it is correct.



The biggest mistake here was not following the directions and labeling the sides x .

- (b) (4 points) Find the length of the two sides of the tent parallel to the tight rope.
Notice that the entire area of the tent floor is 2000 square feet, so the area of each trapezoid is 1000 square feet (since the tight rope cuts the tent into two *equally sized* trapezoids). So we have $1000 = \frac{1}{2} \cdot 20(x + 60)$, $10x + 600 = 1000$, $10x = 400$ and $x = 40$, so the length of each side of the tent parallel to the tight rope is 40 feet.
- (c) (4 points) Suppose all of the circus' elephants take up 35 square feet when viewed from above. Assuming the malleability of the elephants, how many could be placed on the floor of the tent?
There is an implied "each" in this sentence. If you were unclear about this you should have asked me for clarification. So if each elephant takes up 35 square feet and we have 2000 square feet to work with, then we set $35y = 2000$ and get $y \approx 57.14$ so we can get 57 elephants in the tent.

(d) Solve the following linear equations.

(a) (2 points) $17y + 12 = -3y + 4$

$$17y + 12 = -3y + 4$$

$$20y + 12 = 4$$

$$20y = -8$$

$$y = -\frac{8}{20}$$

$$y = -\frac{2}{5}$$

(b) (3 points) $\frac{x-2}{x} + 1 = \frac{x+3}{x}$

First we should note that $x \neq 0$. However since there were only 3 points to give here, I decided not to take off for failure to note that.

$$\begin{aligned}\frac{x-2}{x} + 1 &= \frac{x+3}{x} \\ x\left(\frac{x-2}{x} + 1\right) &= x\left(\frac{x+3}{x}\right) \\ x-2+x &= x+3 \\ 2x-2 &= x+3 \\ x-2 &= 3 \\ x &= 5\end{aligned}$$

Double checking our answer we get

$$\begin{aligned}\frac{5-2}{5} + 1 &= \frac{5+3}{5} \\ \frac{3}{5} + \frac{5}{5} &= \frac{8}{5} \\ \frac{8}{5} &= \frac{8}{5}\end{aligned}$$

So $x = 5$ is a solution.

(c) Perform the indicated operations involving complex numbers and write the result in standard form.

(a) (2 points) $(7+i)(15-2i)$ Here we foil.

$$\begin{aligned}(7+i)(15-2i) &= 105 - 14i + 15i - 2i^2 \\ &= 105 + i - 2(-1) \\ &= 105 + i + 2 \\ &= 107 + i\end{aligned}$$

(b) (3 points) $\frac{5+i}{1-i}$ Here we must multiply by one in a clever way. We use the complex conjugate

$1 + i$ over itself.

$$\begin{aligned}\frac{5+i}{1-i} &= \frac{5+i}{1-i} \cdot \frac{1+i}{1+i} \\ &= \frac{(5+i)(1+i)}{(1-i)(1+i)} \\ &= \frac{5+5i+i+i^2}{1+i-i-i^2} \\ &= \frac{5+6i-1}{1+1} \\ &= \frac{4+6i}{2} \\ &= \frac{4}{2} + \frac{6i}{2} \\ &= 2+3i\end{aligned}$$

(c) Given the following quadratic equation $x^2 + 8x + 15 = 0$ do the following:

(a) (1 point) Find the discriminant of the quadratic.

The discriminant of a quadratic equation is the $b^2 - 4ac$ part of the quadratic equation. Here we have $a = 1, b = 8, c = 15$ so we look at $8^2 - 4(1)(15) = 64 - 60 = 4$. So the discriminant of this quadratic is 4.

(b) (1 point) What does the discriminant tell you about the solutions to the quadratic equation? Here, as $4 > 0$, we know that we will get two (distinct) real solutions.

(c) (3 points) Solve the quadratic equation. This could be done in two ways. I will outline each as subparts.

(a) We can factor the left hand side of this equation.

$$\begin{aligned}x^2 + 8x + 15 &= 0 \\ (x+5)(x+3) &= 0 \\ x+5 = 0 \quad \text{or} \quad x+3 &= 0 \\ x = -5 \quad \text{or} \quad x &= -3\end{aligned}$$

(b) We could use the quadratic equation. In this case

$$\begin{aligned}x &= \frac{-8 \pm \sqrt{(-8)^2 - 4(1)(15)}}{2(1)} \\ &= \frac{-8 \pm \sqrt{4}}{2} \\ &= \frac{-8 \pm 2}{2} \\ &= -4 \pm 1\end{aligned}$$

So $x = -4 - 1 = -5$ or $x = -4 + 1 = -3$.