Team 1

$75\% = 0.75 = \frac{3}{4}$. Now, $\frac{2}{3} \times 75\% \times 0.85x = \frac{2}{3} \times \frac{3}{4} \times 0.85x = \frac{1}{2} \times 0.85x = 0.425x = 100$, so $\frac{4}{5} \times 70\% \times 0.75x = \frac{\cancel{4}}{5} \times \frac{7}{10} \times \frac{3}{\cancel{4}}x = \frac{21}{50}x = 0.42x = 0.42 \times \frac{0.425}{0.425}x = \frac{0.420}{0.425} \times 0.425x = \frac{420}{425} \times 100 = 98.82\ldots$, which rounds to the nearest tenth as **98.8**.

Team 2

The count in the category "Insects" is 3252; the count in all other categories combined, 1892, is less than for the one "Insects" category. Whenever one category has a count that is more than half the total count (that is, the one category has a greater count than all other categories combined), the median value is guaranteed to occur in that one category. All members of that one category in this case have a value of 6, so the median number of legs is **6** legs.

Team 3

The number being divisible by both 2 and 5 means the ones digit must be 0. To be divisible by 3, the sum of the digits must be divisible by 3: $2 + 3 + 4 + h + 6 + 0 = 15 + h$, so the hundreds digit must be divisible by 3, thus 0, 3, 6 or 9. The largest of these, 9, yields the greatest possible overall value for the original number, **234960**.

Team 4

Ailey, and therefore Zander, earn $\frac{47.25}{3}$, which is \$15.75 per hour, so Liz earns $\frac{4}{5} \times 15.75 = \$12.60$ *per* hour. Ailey and Zander worked a combined $3 + 5 = 8$ hours, while Liz worked 12 hours. Therefore, the combined earnings are $8\ \cancel{\text{hours}} \times \frac{\$15.75}{\cancel{\text{hour}}} + 12\ \cancel{\text{hours}} \times \frac{\$12.60}{\cancel{\text{hour}}} = \$126 + \$151.20 = \$277.20$. Of that, $5\% = \frac{1}{20}$ went back into the business, thus $\frac{277.20}{20} = \$\mathbf{13.86}$.

Team 5

Each side of the triangle is the sum of the two radii of the circles forming the side: $1 + 2 = 3$ meters; $1 + 3 = 4$ meters; $2 + 3 = 5$ meters. Therefore, we have a 3-4-5 right triangle whose enclosed area is half the product of the two shorter sides: $\frac{1}{2} \times 3 \times 4 = \mathbf{6}\ \text{m}^2$.

Team 6

For a page number $100h + 10t + u \le 280$, h, t and u represent the hundreds, tens, and units or ones digits, respectively, each at least 0 and at most 9, subject to further constraints, two of which are $h + t + u = 16$ and $h \le 2$. When $h = 0$, $t + u = 16$, so t can range from 7 up to 9, while u ranges from 9 down to 7—making 3 options. When $h = 1$, $t + u = 15$, so t can range from 6 up to 9, while u ranges from 9 down to 6—making 4 options. Careful now: When $h = 2$, $t + u = 14$, so t can range from 5 up to only 7 [due to a page number being at most 280], while u ranges from 9 down to 7—making 3 options. Therefore, the total number of words written is $3 + 4 + 3 = \mathbf{10}$ words.

Team 7

There are $5! = 120$ permutations of the five digits. Each digit value occurs $\frac{1}{5}$ of the time in each digit place. Therefore, each of 1, 2, 3, 4 and 5 occurs 24 times in each digit place, so the sum of the digit values in any one digit-place column is $24(1 + 2 + 3 + 4 + 5) = 24 \times 15 = 360$. To account for the 10,000s place, the 1000s place, the 100s place, the 10s place and the 1s place, we need to multiply the 360 by $10{,}000 + 1000 + 100 + 10 + 1 = 11{,}111$ to end up with the answer $11{,}111 \times 360 = \mathbf{3{,}999{,}960}$.

Team 8

For a regular n-gon, there are always $\frac{n(n-3)}{2}$ diagonals, so for $n = 20$, there are 170 diagonals. When n is even, the longest diagonals go straight across passing through the center to the opposite vertex, and there are 10 such distinct pairings of vertices. The shortest diagonals are obtained by taking any vertex; that vertex is adjacent to two other vertices, and the diagonal joining those two other vertices has the shortest possible length—there are 20 such vertices and 20 such diagonals. Therefore, of the 170 diagonals, we are rejecting $10 + 20 = 30$ and thus keeping 140. The probability is, therefore, $\frac{140}{170} = \mathbf{\frac{14}{17}}$.

Team 9

Line 1: either ‘2’ or ‘3’ first, so 2 orderings; 4 choices for the ‘2’; 3 choices for the ‘3’;
thus, $2 \times 4 \times 3 = 24$ distinct lines.
Line 2: ‘3’ in any of 3 positions, so 3 orderings; 3×2 choices for the ‘2’s; 2 choices for the ‘3’;
thus, $3 \times 3 \times 2 \times 2 = 36$ distinct lines.
Line 3: either ‘2’ or ‘3’ first, so 2 orderings; 1 choice left for the ‘2’; 1 choice left for the ‘3’;
thus, $2 \times 1 \times 1 = 2$ distinct lines.
Putting the options together for all three lines: $24 \times 36 \times 2 = \mathbf{1728}$ haiku.

Team 10

The square root causes major difficulties for having an integer result. It is necessary to have $\sqrt{ab} = \sqrt{40b} = 2\sqrt{10b}$ be an integer, so $10b$ must be a perfect square, so it must be that $b = 10n^2$ for some integer $n > 2$. If n is divisible by 3, then the second and third terms in the numerator $40 + 20n + 10n^2$ are divisible by 3 but the first term is not, so the numerator cannot be divisible by 3. We can crank a few cases quickly, so let’s not analyze more. Because $n > 3$, first try $n = 4$: $40 + 80 + 160 = 280$—not divisible by 3. Next try $n = 5$: $40 + 100 + 250 = 390$—yes, divisible by 3. Therefore, the least $b > 2$ is $b = 10 \times 5^2 = \mathbf{250}$.