

MATHCOUNTS[®] Problem of the Week Archive

National Bike Month – May 11, 2020

Problems & Solutions

May is National Bike Month, so here are a few problems related to bicycles.

Brenden is riding an old-time bicycle that has a back wheel with a diameter of 1 foot and a front wheel with a radius of 1.5 feet. After traveling 1000 feet, how many more rotations than the front tire has the back tire completed? Express your answer to the nearest whole number.

$$1000 \text{ ft} / [(0.5)(2)(\pi)] = 318.309886 \text{ rotations of the back wheel}$$

$$1000 \text{ ft} / [(1.5)(2)(\pi)] = 106.103295 \text{ rotations of the front wheel}$$

$$318.309886 - 106.103295 = \mathbf{212 \text{ rotations}} \text{ to the nearest full rotation}$$

Jermaine starts riding his bike at a rate of 10 miles per hour. After 5 minutes, Nelson starts riding from the same starting point as Jermaine and along the same route at a rate of 12 miles per hour. If each boy rides at a constant rate, how many minutes will Jermaine ride his bike for before Nelson catches up with him?

Let's call the time that both boys are riding t . We know that once Nelson catches up to Jermaine, the two boys will have each ridden the same distance. Let's call that distance d . Thus, for Jermaine, we can say $10 = d/(t + 5/60)$ and for Nelson, we can say $12 = d/t$. Let's set both equations equal to d .

$$d = 10(t + 5/60) \text{ and } d = 12t \rightarrow 10(t + 5/60) = 12t$$

Now, we can solve for t .

$$10t + 5/6 = 12t \rightarrow 5/6 = 2t \rightarrow t = 5/12 \text{ hours}$$

We're asked for an answer in minutes, so $(5/12)(60) = 25$ minutes. Therefore, Jermaine rode for $25 + 5 = \mathbf{30 \text{ minutes}}$.

At Your Town Bike Shop, handle bar streamers are sold in packs of two and beads for spokes are sold in sets of 10. Georgina purchases 2 packs of handle bar streamers and 3 sets of beads for \$27.85 before tax. Alexis purchases 1 pack of streamers and 4 sets of beads for \$26.30 before tax. If Nana wants to buy 3 packs of streamers and 6 sets of beads, how much will her bill be before tax?

Let's let h represent the price of one handle bar streamers pack and b represent the price of one set of beads. Since Georgina purchases 2 packs of handle bar streamers and 3 sets of beads for \$27.85, we can say that $2h + 3b = 27.85$. Since Alexis purchases 1 pack of streamers and 4 sets of beads for \$26.30, we can also say that $h + 4b = 26.30$.

With two equations and two variables, we can solve the system of equations:

$$h + 4b = 26.30$$

$$2h + 3b = 27.85$$

By solving the top equation for h, we can use substitution to solve for b.

$$h = 26.30 - 4b$$

$$2(26.30 - 4b) + 3b = 27.85$$

$$52.60 - 8b + 3b = 27.85$$

$$5b = 24.75$$

$$b = 4.95$$

Substituting this value for b into one of the equations will allow us to solve for h:

$$h + 4(4.95) = 26.30$$

$$h = 26.30 - 19.80$$

$$h = 6.50$$

Thus, 3 packs of streamers and 6 sets of beads cost $3(6.50) + 6(4.95) = 19.50 + 29.70 = \mathbf{\$49.20}$.

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