# Questions for Maths Fair

Round One Answers:

1) G = 26, J = 18, M = 22

2) Now $180 = 2^2 \times 3^2 \times 5^1$ therefore to be a perfect cube we need our x value to be $2^1 \times 3^1 \times 5^2$ in order to become $2^3 \times 3^3 \times 5^3 = 30^3$ Therefore x = 150

3) $\frac{24x^2+25x-47}{ax-2} = -8x - 3 - \frac{53}{ax-2}$ becomes $\frac{24x^2+25x-47}{ax-2} = \frac{-8x(ax-2)-3(ax-2)-53}{ax-2}$ take away the fractions from both sides and it becomes $24x^2 + 25x - 47 = -8x(ax-2) - 3(ax-2) - 53$

simplify further and it becomes $24x^2 + 25x - 47 = -8ax^2 + 16x - 3ax - 47$

compare both sides and $24 = -8a$ therefore $a = -3$

4) $\frac{16^x}{2^y} = \frac{2^{4x}}{2^y} = 2^{4x-y} = 2^8 = 2^4 \times 2^4 = 16 \times 16 = 256$

5) $133/701$

Round Two Answers:

1) Let x be the number of students in the class. Then $6x + 21 = 7(x-1) + 5$. Therefore $x = 23\ students$

2) $x + \frac{1}{y+\frac{1}{z}} = \frac{37}{16} = 2 + \frac{5}{16}$ Therefore by comparison x = 2. $\frac{1}{y+\frac{1}{z}} = \frac{5}{16}$ so $y + \frac{1}{z} = \frac{16}{5} = 3 + \frac{1}{5}$ Once again by comparison y = 3 and z = 5. Therefore x + y + z = 10.

3) To get to class, Sally ran distance $= speed \times distance = \frac{10km}{hour} \times 6\ minutes =$

$$\frac{10km}{hour} \times \frac{6}{60} hours = 1\ km$$

to run that 1km in 8 minutes would be $speed = \frac{distance}{time} = \frac{1km}{\frac{8}{60}} = \frac{60}{8} = 7.5\ km/hour$

4) There is one 1's, two 2's, three 3's etc. therefore using $1 + 2 + 3 + 4 + \cdots + n = \frac{n(n+1)}{2}$

we want $\frac{n(n+1)}{2} \approx 800$ so $\frac{n(n+1)}{1} = 1600$ and n is around 40

5) The first example is 8 twenties and 8 ones so 'is' represents 8 and 'maths' represents 'twenties' and 'fun' represents 'ones'. The second example is 2 twenties and 3 ones so 'not' is 2 and 'never' is 3. Therefore 'never maths not fun' is 3 twenties and 2 ones. The answer is 62

Round Three Answers:

1) 18 hours left on Friday and 19 hours on Saturday. Therefore it is 37 hours all together.
There are 4 songs per hour. Therefore, he listens to 148 songs.

2) 36

3) If there is 1L of soda then 800ml is water. If 75% of the water is removed, then 200ml of water remains in the remaining 400mL. The concentrated soda will contain 50% water.

4) The car is travelling at 10km/h relative to the truck. To pass the truck time taken t = distance/speed = 20m/10km/h = (20/1000km) / (10km/h) = (2060×60) seconds / (1000×10) = 72/10 = 7.2 seconds

5) In 10 minutes the minute hand will move 10 minutes, or $\frac{10}{60} \times 360^\circ = 60^\circ$ In 10 minute the hour hand will move $\frac{1}{6} \times \frac{1}{12} \times 360^\circ = 5^\circ$ The angle between the hands will be $90^\circ + 5^\circ - 60^\circ = 35^\circ$

Round Four Answers

1) The maximum number of bags that contain 4 Candy bars is 7

2) Treat the inside of the graph like 4 triangles. Since they are symmetric, they have they same areas. $4 \times \frac{8 \times 8}{2} = 4 \times 32 = 128$

3) He is 3km away from the docks.

4) Michael can ink all the pages up to page 129

5) $7^4 = 2401$ which finishes with a 1, since 4 is a factor of 2016, $7^{2016}$ also finishes with a 1

Round Five Answers

1) $9^{2016} + 9^{2016} + 9^{2016} = 3 \times 9^{2016} = 3 \times (3^2)^{2016} = 3 \times 3^{2 \times 2016} = 3 \times 3^{4032} = 3^{4033}$

2) There are 21 different ways

| | | | | |
|---|---|---|---|---|
| 125 | 134 | 116 | 233 | 224 |
| 152 | 143 | 161 | 323 | 242 |
| 215 | 314 | 611 | 332 | 422 |
| 251 | 341 | | | |
| 512 | 413 | | | |
| 521 | 431 | | | |

3) 15/36 = 5/12

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | = | < | < | < | < | < |
| 2 | > | = | < | < | < | < |
| 3 | > | > | = | < | < | < |
| 4 | > | > | > | = | < | < |
| 5 | > | > | > | > | = | < |
| 6 | > | > | > | > | > | = |

4) x is equal to the square root of 4

5) 3. They are 195,156,117