

Challenge '24 Solutions

1. Sagittarius			
Edmond: $120 = 40 + 5 \cdot 16$ Nicholas: $110 = 2 \cdot 23 + 4 \cdot 16$ James: $100 = 4 \cdot 17 + 2 \cdot 16$			3 marks: (1 mark for each solution)
2. Auriga and Centaurus			
Auriga wins by a quarter section. The middle section they are the same. If it takes Auriga one unit of time for each section, then <u>it takes Centaurus $\frac{1}{2}$ a unit for the first and 2 units for the 3rd.</u> So, Centaurus <u>finishes $\frac{1}{2}$ a unit of time behind</u> , so when Auriga crosses the finish line, <u>he has $\frac{1}{4}$ of a section to go.</u>			3 marks: (1 mark a quarter section, 1 mark for both times for Centaurus to complete first and last sections, 1 mark for $\frac{1}{2}$ a unit of time behind)
3. Aries			
4	7	4	3 marks: (1 mark for 4 and 7, 1 mark for diagram, 1 mark for some reasoning)
7		4	
4	4	7	

Challenge '24 Solutions

<p>4. Taurus</p>	<p>5 marks: (2 for 1st route, 1 for each additional route, penalty of 1 mark for any duplicated / or incorrect route)</p>
<p>5. Canis Minor, Lepus and Lacerta</p> <p>Since there were $25 + 19 + 10 = 54$ pets, and no more than 2 pets in any one house, there were pets in at least 27 houses.</p> <p>Given that 5 of the 32 houses had no pets, <u>there must be pets in exactly 27 houses.</u></p> <p><u>It follows that there are no families with more than 3 children.</u> 25 houses have lizards, thus <u>the remaining 2 must have a hare and a small dog.</u></p>	<p>3 marks: (1 mark for 27 houses with pets, 1 mark for no families with >3 children, 1 mark for 2 houses with a hare and a small dog)</p> <p>Award all 3 marks for any correct answer with reasoning</p>
<p>6. Gemini</p> <p>$1865 = 1024 + 841 = 32^2 + 29^2$, so Castor's photograph of himself is <u>32cm long</u> and his photograph of Pollux is <u>29cm long</u>. $1865 = 16 + 1849 = 4^2 + 43^2$, so Pollux's photograph of Castor is <u>4cm long</u> and his photograph of himself is <u>43cm long</u>.</p>	<p>4 marks: (1 for finding 32 and 29, 1 for finding 4 and 43, 1 for C = 32 and P = 29, 1 for C = 4 and P = 43)</p>
<p>7. Aquarius</p> <p>Barrel = $0.0625\pi \text{ m}^3 = 62500\pi \text{ cm}^3$, $\frac{3}{4} = 46875\pi \text{ cm}^3$ Bucket = $2430\pi \text{ cm}^3$, losing 10% leaves $2187\pi \text{ cm}^3$ $46875 / 2187 = 21.433$, so 22 buckets required (note that pi cancels out)</p>	<p>6 marks: (1 mark for volume of barrel, 1 mark for volume of bucket, 1 mark for loss from bucket, 1 mark for net in bucket, 1 mark for correct division, 1 mark for rounding up to 22)</p>