

Challenge 2021 Maths 2 solutions

1) $\frac{28}{124} = 0.226 \text{ miles per minute (3sf)}$

$\frac{25}{113} = 0.221 \text{ miles per minute (3sf)}$

So Joseph cycled faster on average

2) 11.28p per kilowatt-hour

3) 33.36 psi

4) a) i) $\frac{3x-1}{4}$

ii) $\frac{y^2}{4x^2}$

b) $\sqrt[3]{1 - \frac{3}{P}}$

c) $33\frac{1}{2}$

5) £550

6) 3

7) a) 6554

b) 39801

8) 1:46pm

9) 11 litres of P and 8.25 litres of Q

10) $x=15.6\text{cm}$, $y=9.42\text{cm}$

11) 9cm^2

12) 14.2cm

13)a) 3,5,8,4,1,2,7,6,9

b) If 4 then we need 3 additional digits that add to 26. But even if we take the largest (7,8,9) then we get only 24.

If 8 then the last digit could be at most 9 so the minimum sum for the 8 leftmost digits is $45-9=36$.

c)

Leftmost digit	Possible list	Sum	Works?
1	1	1	No
2	2,9 (maximum)	11	No
3	3,9,5	17	Yes
4	4,9,3,1; 4,7,1,5	17	Yes
5	5,1,2,3,6 is the only one	17	Yes
6	6,1,2,3,4,5 (minimum)	21	No (and nothing larger will either by the same reasoning)

d) Already know that it must start and end with 3,4,5 by using part c.

Can't have 5 as there is only one possible list (ignoring permutations) so 1,2,3,6 would have to be repeated in our list, e.g. 5,1,2,3,6,3,2,1,5. But repetition not allowed.

For 3 and 4 we could have e.g. 3,9,5,6,8,7,1,5,4.

14)a) i) $\angle ACD = \angle XAB$ and $\angle ABX = \angle XDC$ by alternate angles.

$\angle AXB = \angle CXD$ by vertically opposite angles.

All angles in the triangles are the same so similar.

ii) 135mm

iii) $AX=72\text{mm}$

$$AX^2 + BX^2 = AB^2 \text{ as required}$$

b) 44.78cm

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