Mathematics 25.08.22 (2) Notes

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Contents

Section 1 Money Conversion

Example 1.1. (Money Conversion) Euro1 = £0.84 = s$1.39. Euro29.04 to £: 24.39£. s$74.08 to Euros: Euro53.29. £90 to s$: s$148.93.

Section 2 Ratio

Example 2.1. (Ratio) $3600 is shared in the ratio $4 : 6 : 8$.

(1) Can we simplify this ratio? $4 : 6 : 8 = 2 : 3 : 4$.

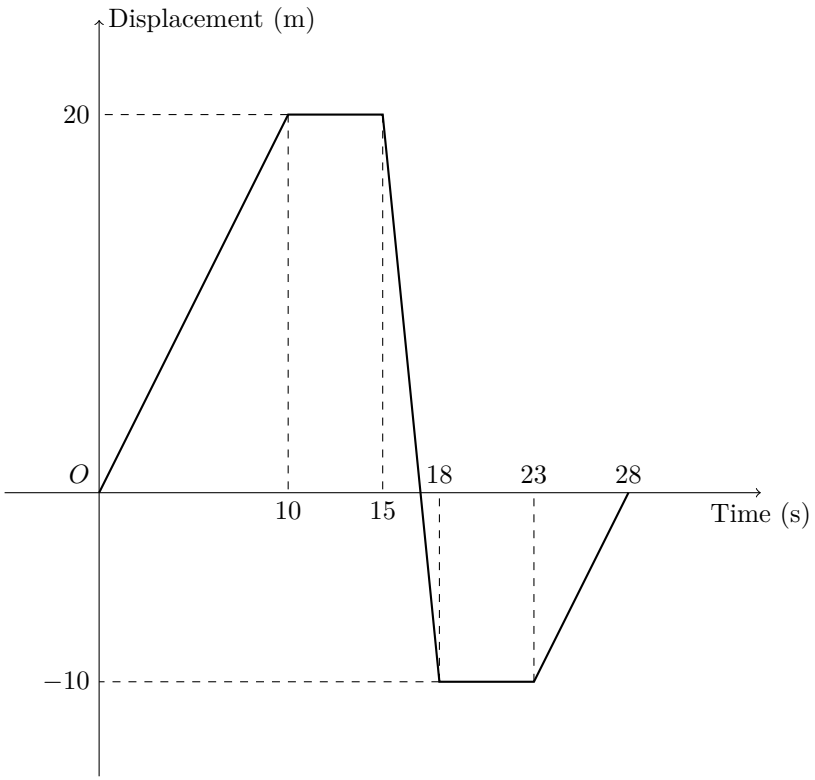
(2) What does each person get? Each part is $\$3600 \div (2 + 3 + 4) = \$400$. $\$400 \times 2 = \$800, \$400 \times 3 = \$1200, \$400 \times 4 = \$1600$.

(3) What fraction does the lowest share get? $\frac{2}{2+3+4} = \frac{2}{9}$.

Problem 2.2. Money is shared in ratio $1 : 5$. If the smaller share is £40, what is the total share?
Solution. $£40 \div 1 \times (1 + 5) = £240$.

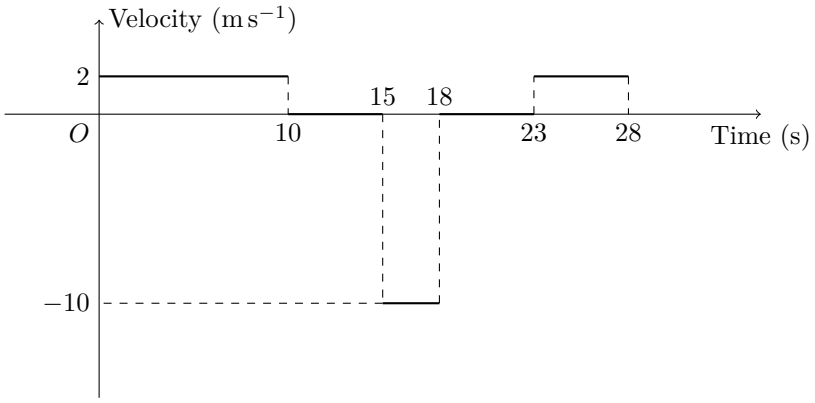
Section 3 Graphs

Example 3.1. (Displacement-Time Graph) Describe the movement of the object.



Time	Direction	Velocity
$0-10$	Positive	$20\,\mathrm{m\,s^{-1}}$
$10-15$	At Rest	0
$15-18$	Negative	$-10\,\mathrm{m\,s^{-1}}$
$18-23$	At Rest	0
$23-28$	Positive	$2\,\mathrm{m\,s^{-1}}$

Example 3.2. (Velocity-Time Graph) Draw the Velocity-Time Graph of this motion.



Definition 3.3. (Average Velocity, Average Speed)

$$\text{Average Velocity} = \frac{\text{Total Displacement}}{\text{Total Time}},$$

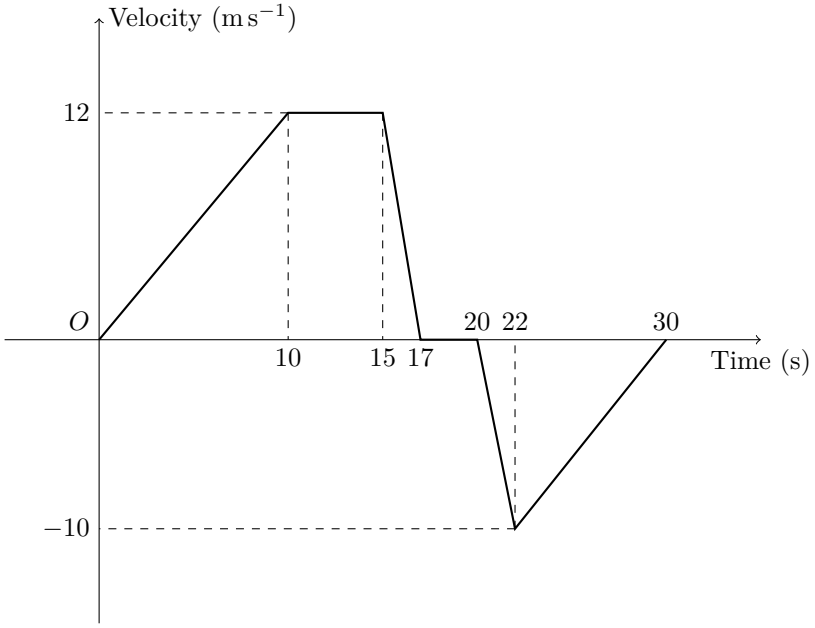
$$\text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}}.$$

Example 3.4. (Average Velocity, Average Speed) Calculate the Average Velocity and Average Speed of the previous example.

$$\text{Average Velocity} = \frac{\text{Total Displacement}}{\text{Total Time}} = \frac{0\,\text{m}}{28\,\text{s}} = 0,$$

$$\text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}} = \frac{60\,\text{m}}{28\,\text{s}} = 2.14\,\text{m}\,\text{s}^{-1}.$$

Example 3.5. (Velocity-Time Graph) Describe the movement of the object.



Time	Direction of Movement	Velocity	Direction of Acceleration	Acceleration
$0-10$	Positive	N/A	Positive	$1.2\,\text{m}\,\text{s}^{-2}$
$10-15$	Positive	$12\,\text{m}\,\text{s}^{-1}$	Zero	0
$15-17$	Positive	N/A	Negative	$-6\,\text{m}\,\text{s}^{-2}$
$17-20$	At Rest	0	Zero	0
$20-22$	Negative	N/A	Negative	$-5\,\text{m}\,\text{s}^{-2}$
$22-30$	Negative	N/A	Positive	$1.25\,\text{m}\,\text{s}^{-2}$

Method 3.6. (Calculating Displacement/Distance via a Veloity/Speed Graph)

$$\begin{aligned} S &= \int \mathrm{d}S \\ &= \int v\mathrm{d}t, \end{aligned}$$

therefore the Displacement/Distance is the area below the Veloity/Speed curve.

Example 3.7. (Calculating Displacement/Distance via a Veloity/Speed Graph) Calculate the displacement and the distance of the previous example.

$$\begin{aligned} \text{Displacement} &= 10\,\text{s} \times 12\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} + 5\,\text{s} \times 12\,\text{m}\,\text{s}^{-1} + 2\,\text{s} \times 12\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} \\ &\quad + 2\,\text{s} \times -10\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} + 8\,\text{s} \times -10\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} \\ &= 82\,\text{m}. \end{aligned}$$

$$\begin{aligned}\text{Distance} &= 10\,\text{s} \times 12\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} + 5\,\text{s} \times 12\,\text{m}\,\text{s}^{-1} + 2\,\text{s} \times 12\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} \\ &\quad + 2\,\text{s} \times 10\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} + 8\,\text{s} \times 10\,\text{m}\,\text{s}^{-1} \times \frac{1}{2} \\ &= 182\,\text{m}.\end{aligned}$$

Example 3.8. (Calculating Average Velocity/Speed)

$$\text{Average Velocity} = \frac{\text{Total Displacement}}{\text{Total Time}} = \frac{82\,\text{m}}{30\,\text{s}},$$

$$\text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}} = \frac{182\,\text{m}}{30\,\text{s}}.$$