

APOLLO

Galilean and special relativity

HL

Physics

First assessment 2025

10 questions | mark schemes

Mark-scheme answers

Physics HL | Paper 1A | May 2025 TZ1 | Q9 | 1 marks

9. B

Physics HL | Paper 1A | May 2025 TZ3 | Q9 | 1 marks

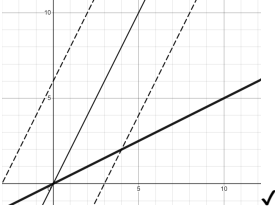
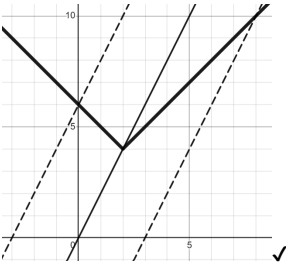
9. B

6.	a		$\gamma = \frac{1}{\sqrt{1-0.60^2}} \text{ OR } \frac{5}{4} \text{ OR } 1.25 \quad \checkmark$ $t = \gamma t' \Rightarrow t' = \frac{4}{5} \times 50 = 40 \text{ yr} \quad \checkmark$	Award MP1 if seen isolated or within an equation. Award [2] if 40 <<yr>> is seen as the answer without working	[2]
	b	i	45 degree line starting at (30, 50) and ending on Earth's time axis (at A) $\checkmark$		[1]

	b	ii	Alternative 1 Line from A parallel to S space axis intersects S time axis at B: $ct = 125 \text{ ly} \quad \checkmark$ Knowing scale on S time axis gives S time at B of $40+40+20 = 100 \text{ yr} \quad \checkmark$ Time of travel is $100 - 40 = 60 \text{ yr} \quad \checkmark$ Alternative 2 Distance separating P and Earth in S is $\frac{30}{\gamma} = 24 \text{ ly} \quad \checkmark$ $cT = 0.60cT + 24 \quad \checkmark$ $T = \frac{24}{0.40c} = 60 \text{ yr} \quad \checkmark$	Accept 55 to 65 years for those using Alt 1 MP1 for Alt. 3 can be explicit from graph in (b) i	[3]
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		Alternative 3 Travel time for signal for Earth is 30 years so event A has time coordinate $50 + 30 = 80$ yr ✓ S time for A is $ct' = \gamma(ct - \frac{v}{c}x) = \frac{5}{4} \times 80 = 100$ ly ✓ Time of travel is $100 - 40 = 60$ yr ✓ Alternative 4 Calculate time elapsed between signal emitted and signal received as: $\Delta t = 30$ ✓ $\Delta x = -30$ ✓ Use of Lorentz transformation to get $\Delta t' = 60$ ✓	<i>If candidates use positive Δx and a negative velocity, award [2]</i>	
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Question	Answers	Notes	Total
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2.	a	line through origin of gradient 0.5 (by eye) 		1
2.	b	two lines of gradient -1 and 1 from E (by eye) 		1

2.	c	«simultaneous for» the passenger ✓ because line joining T_B and T_F is parallel to x' axis «so identify the same time coordinate» ✓	Accept equivalent description based on non-simultaneous for the observer.	2
2.	d	6 «m» ✓		1

Question	Answers	Notes	Total
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Mark-scheme answers

Physics HL | Paper 1A | Nov 2025 TZ1 | Q8 | 1 marks

8. D

Physics HL | Paper 1A | Nov 2025 TZ1 | Q9 | 1 marks

9. D

Physics HL | Paper 1A | Nov 2025 TZ3 | Q8 | 1 marks

8. B

Physics HL | Paper 1A | Nov 2025 TZ3 | Q9 | 1 marks

9. A

Physics HL | Paper 1A | Specimen 2025 | Q9 | 1 marks

9. A

2.	a		$\gamma = \frac{1}{\sqrt{1-0.80^2}} = \frac{5}{3} = 1.67 \checkmark$		1
2.	b	i	$\llbracket \Delta x' = \gamma(\Delta x - v\Delta t) \rrbracket = \frac{5}{3} \times 1200 = 2000 \text{ «m»} \checkmark$	Allow ecf from 1a. Allow use of $L = \frac{L_0}{\gamma}$.	1
2.	b	ii	$\llbracket \Delta t' = \gamma(\Delta t - \frac{v}{c^2}\Delta x) \rrbracket = \frac{5}{3}(0 - \frac{0.80}{3 \times 10^8} \times 1200) \checkmark$ $\Delta t' = \llbracket - \rrbracket 5.3 \text{ «}\mu\text{s}\rrbracket \checkmark$	Allow use of $\Delta t = \gamma\Delta t_0$.	2
2.	c		Because $\Delta t' < 0 \checkmark$ F occurred first $\checkmark$	2 nd MP only awarded if correct interpretation of 1 st MP.	2

Question	Answers	Notes	Total
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