Pearson Edexcel

Mark Scheme (Topic Test)

Linear Combinations

Pearson Edexcel GCE
In Statistics (9ST0)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

April 2026 version 2

General Marking Guidance

Total marks

The total number of marks for the paper is 50.

Mark types

The Edexcel Statistics mark schemes use the following types of marks:

- **M** **Method** marks,
  awarded for 'knowing a method and attempting to apply it',
  unless otherwise indicated.
- **A** **Accuracy** marks can only be awarded if the relevant method (M) marks have been earned.
- **B** **Unconditional accuracy** marks are independent of M marks
- **E** **Explanation** marks

NOTE: Marks should not be subdivided.

Abbreviations

These are some of the marking abbreviations that will appear in the mark schemes.

- ft follow through
- PI possibly implied
- cao correct answer only
- cso correct solution only
  (There must be no errors in this part of the question)
- awrt answers which round to
- awfw answers which fall within (a given range)
- SC special case
- nms no method shown
- oe or equivalent
- dep dependent (on a given mark or objective)
- dp decimal places
- sf significant figures
- ∗ The answer is printed on the paper

Further notes

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied **positively**. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is **no ceiling** on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- All A marks are 'correct answer only' (cao), unless shown, for example, as A1ft to indicate that previous wrong working is to be followed through.
- All M marks are 'possibly implied' (PI) unless specifically stated otherwise in the 'Notes' column.
- After a **misread**, the subsequent A marks affected are treated as A1ft, but manifestly absurd answers should never be awarded A marks.
- **Crossed out** work should be marked UNLESS the candidate has replaced it with an alternative response.
- If **two solutions** are given, each should be marked, and the resultant mark should be the mean of the two marks, rounded down to the nearest integer if needed.

Question	Scheme	Marks	AO	Notes
1(a)	[X = the weight of a barrel of resin, Y = the weight of a barrel of activator]			
	$X \sim \mathrm{N}(65, 1.5^2)$ and $Y \sim \mathrm{N}(70, 2^2)$			
	$\mathrm{E}(X+Y) = 65 + 70 = 135$	B1	1.2	cao
	$\mathrm{Var}(X+Y) = 1.5^2 + 2^2 = 6.25$	M1	1.2	Variance method
		A1	1.2	cao
1(b)	$\mathrm{P}(X+Y > 138) = 0.115$	B1	1.2	awrt
1(c)	The weights of barrels of resin and activator are independent of each other	E1	2.1b	
1(d)	$1.59X + 1.28Y$	B1	1.2	awrt
	Total	**6**		

Question	Scheme	Marks	AO	Notes
	[A = Wing length, B = Tail length, C = Tarsus length, D = Culmen length, E = Culmen width]			
2(a)(i)	$C \sim \mathrm{N}(11.52, 0.59^2)$			
	$\mathrm{P}(C > 12) = 0.208$	B1	1.2	cao
2(a)(ii)	$A \sim \mathrm{N}(106.87, 2.31^2)$ and $B \sim \mathrm{N}(46.13, 1.83^2)$			
	$\mathrm{P}(A > 2.5B)$ $\left(= \mathrm{P}(A - 2.5B > 0)\right)$	B1	1.2	Correct expression
	$\mathrm{E}(A - 2.5B) = 106.87 - 2.5 \times 46.13 = -8.455$	B1	1.2	awrt $(\pm)8.46$
	$\mathrm{Var}(A - 2.5B) = 2.31^2 + 2.5^2 \times 1.83^2$	M1	1.2	Variance method
	$= 26.266725$	A1	1.2	awrt 26.3
	$\mathrm{P}(A - 2.5B > 0) = 0.0495$	A1	1.2	awfw 0.0494~0.0497
2(b)	[I = Selection index]			
	$I = A + B + C + D + E$			
	$\mathrm{E}(I) = 177.73$	B1	1.2	
	$\mathrm{Var}(I) = 2.31^2 + 1.83^2 + 0.59^2 + 0.31^2 + 0.37^2$	M1	1.2	Variance method
	$= 9.2661$	A1	1.2	
	$\mathrm{P}(160 \leq I \leq 170) = 0.00555$	A1	1.2	awrt
	Total	**10**		

Question	Scheme	Marks	AO	Notes
	[S = Weight of sponge base, D = Weight of jelly disc, C = Weight of chocolate]			
3(a)	$J = S + D + C$			
	$\mathrm{E}(J) = 6.5 + 3 + 2.7 = 12.2$	B1	1.2	cao
	$\mathrm{Var}(J) = 0.25^2 + 0.15^2 + 0.2^2$	M1	1.2	Variance method
	$= 0.125$	A1	1.2	cao
3(b)	$J \sim \mathrm{N}(12.2, 0.125)$			
	$\mathrm{P}(J < 12) = 0.286$	B1	1.2	awrt
3(c)	[P = Weight of paper tray, B = weight of cardboard box]			
	$T = P + B + J_1 + \cdots + J_8$			
	$\mathrm{E}(T) = 6 + 7 + 8 \times 12.2 = 110.6$	B1	1.2	cao
	$\mathrm{Var}(T) = 0.5^2 + 0.6^2 + 8 \times 0.125$	M1	1.2	Variance method
	$= 1.61$			
	Therefore $T \sim \mathrm{N}(110.6, 1.61)$	A1	1.2	Correct variance and conclusion
3(d)	$\mathrm{P}(T < 110) = 0.318$	B1	1.2	awrt
3(e)	May not be a good decision since 32% of boxes of Jaffa cakes will be under the stated weight	E1	3.1b	Allow e.g. "nearly a third" Must refer to probability calculated in (d) FT their probability provided > 20%
	Total	**9**		

Question	Scheme	Marks	AO	Notes
4(a)	Since n is large ($58 \geq 30$) we may assume the average lap time for both drivers may be normally distributed by the Central Limit Theorem	E1	2.1b	
4(b)	$\mathrm{E}(P) = 58 \times 90.04 = 5222.32$ and $\mathrm{E}(V) = 58 \times 89.95 = 5211.30$	B1	1.2	Either
	$\mathrm{Var}(P) = 58 \times 4.98^2$ OR $58^2 \times \frac{4.98^2}{58} = 1438.42$	M1	1.2	Either
	$\mathrm{Var}(V) = 58 \times 3.97^2$ OR $58 \times \frac{3.97^2}{58} = 914.13$			
		A1	1.2	AG Both means and both variances correctly shown
	Since both the average lap times are normally distributed and any linear combination of (independent) normal variables is itself normally distributed, $P \sim \mathrm{N}(5222.32, 1438.42)$ and $V \sim \mathrm{N}(5211.30, 914.13)$	E1	2.1b	Full conclusion Allow "multiple" in place of "linear combination"
4(c)	$\mathrm{P}(P < V)$ $\left(= \mathrm{P}(P - V < 0)\right)$	M1	2.1b	Correct expression
	$\mathrm{E}(P - V) = 5222.32 - 5211.30 = 11.02$	B1	1.2	
	$\mathrm{Var}(P - V) = 1438.42 + 914.13$	M1	1.2	Variance method
	$= 2352.55$	A1	1.2	
	$\mathrm{P}(P - V < 0) = 0.410$	A1	1.2	awrt
4(d)	The race times between Piastri and Verstappen may not be independent of each other if e.g. Piastri drives in a way which may slow Verstappen down	E1	3.1a	Any contextual violation of independence
	Total	**11**		

Question	Scheme	Marks	AO	Notes
5(a)	[E_S = Annual electricity bill for a small household]			
	$\mathrm{P}(E_S > 700) = 0.368$	B1	1.2	awrt
5(b)	[G_M = Annual gas bill for a medium household]			
	$\overline{G_M} \sim \mathrm{N}\left(836.79, \frac{250.61^2}{3}\right)$	M1	2.1b	
	$\mathrm{P}\left(\overline{G_M} < 900\right) = 0.669$	A1	1.2	awrt
5(c)	[G_L = Annual gas bill for a large household]			
	$\mathrm{P}\left(G_L > 1.2\overline{G_M}\right)\ \left(= \mathrm{P}\left(G_L - 1.2\overline{G_M} > 0\right)\right)$	M1	2.1b	Correct expression
	$\mathrm{E}\left(G_L - 1.2\overline{G_M}\right) = 1184.94 - 1.2 \times 836.79 = 180.792$	B1	1.2	awrt 180.8
	$\mathrm{Var}\left(G_L - 1.2\overline{G_M}\right) = 326.48^2 + 1.2^2 \times \frac{250.61^2}{3}$	M1	1.2	Variance method
	$= 136735.769$	A1	1.2	awrt 136736
	$\mathrm{P}\left(G_L - 1.2\overline{G_M} > 0\right) = 0.688$	A1	1.2	awrt
5(d)	[W_S = Annual water bill for a small household, G_S = Annual gas bill for a small household, E_S = Annual electricity bill for a small household]			
	$\mathrm{P}\left(W_S > \frac{G_S + E_S + W_S}{3}\right)$	M1	2.1b	Correct expression
	Method 1			
	$\Rightarrow \mathrm{P}(2W_S - G_S - E_S > 0)$	A1	1.2	oe
	$\mathrm{E}(2W_S - G_S - E_S) = 2 \times 507 - 640.59 - 583.59 = -210.18$	B1	1.2	
	$\mathrm{Var}(2W_S - G_S - E_S) = 2^2 \times 98.46^2 + 175.53^2 + 150.18^2$	M1	1.2	Variance attempt
	$= 92142.2997$	A1	1.2	awrt 92142
	$\mathrm{P}\left(W_S > \frac{G_S + E_S + W_S}{3}\right) = 0.244$	A1	1.2	

Question	Scheme	Marks	AO	Notes
5(d) (cont.)	**Method 2**			
	$\Rightarrow \mathrm{P}\left(\frac{2}{3}W_S - \frac{1}{3}G_S - \frac{1}{3}E_S > 0\right)$	(M1)		oe
	$\mathrm{E}\left(\frac{2}{3}W_S - \frac{1}{3}G_S - \frac{1}{3}E_S\right) = \frac{2}{3} \times 507 - \frac{1}{3} \times 640.59 - \frac{1}{3} \times 583.59$			
	$= -70.06$	(B1)		
	$\mathrm{Var}\left(\frac{2}{3}W_S - \frac{1}{3}G_S - \frac{1}{3}E_S\right)$			
	$= \left(\frac{2}{3}\right)^2 \times 98.46^2 + \left(\frac{1}{3}\right)^2 \times 175.53^2 + \left(\frac{1}{3}\right)^2 \times 150.18^2$	(M1)		Variance attempt
	$= 10238.0333$	(A1)		awrt 10238
	$\mathrm{P}\left(W_S > \frac{G_S + E_S + W_S}{3}\right) = 0.244$	(A1)		
	Total	**14**		