

1. (a) $r = \frac{8825}{\sqrt{1022500 \times 130.9}}, \quad = \text{awrt } \underline{0.763}$ M1 A1 2

Note

M1 for a correct expression, square root required
Correct answer award 2/2

- (b) Teams with high attendance scored more goals
(oe, statement in context) B1 1

Note

Context required (attendance and goals). Condone causality.
B0 for 'strong positive correlation between attendance and goals'
on its own oe

- (c) 0.76(3) B1ft 1

Note

Value required.
Must be a correlation coefficient between -1 and +1 inclusive.
B1ft for 0.76 or better or same answer as their value from part (a)
to at least 2 d.p.

[4]

2. (a) $S_{pp} = 106397 - \frac{833^2}{7} = 7270$ M1 A1

$$S_{pp} = 42948 - \frac{341 \times 833}{7} = 2369,$$

$$S_{tt} = 18181 - \frac{341^2}{7} = 1569.42857.... \text{ or } \frac{10986}{7}$$
 A1 A1 4

Note

M1 for at least one correct expression

1st A1 for $S_{pp} = 7270$, 2nd A1 for $S_{tp} = 2369$ or 2370,

3rd A1 for $S_{tt} = \text{awrt } 1570$

(b) $r = \frac{2369}{\sqrt{7270 \times 1569.42857...}}$ M1 A1ft
 $= 0.7013375$ awrt (0.701) A1 3

Note

M1 for attempt at correct formula and at least one correct value (or correct ft) M0 for

$$\frac{42948}{\sqrt{106397 \times 18181}}$$

A1ft All values correct or correct ft. Allow for an answer of 0.7 or 0.70 Answer only: awrt 0.701 is 3/3, answer of 0.7 or 0.70 is 2/3

(c) (Pmcc shows positive correlation.)

Older patients have higher blood pressure B1 1

Note

B1 for comment in context that interprets the fact that correlation is positive, as in scheme.

Must mention age and blood pressure in words, not just “*t*” and “*p*”.

(d) Points plotted correctly on graph: –1 each error or omission

(within one square of correct position) B2 2

Note

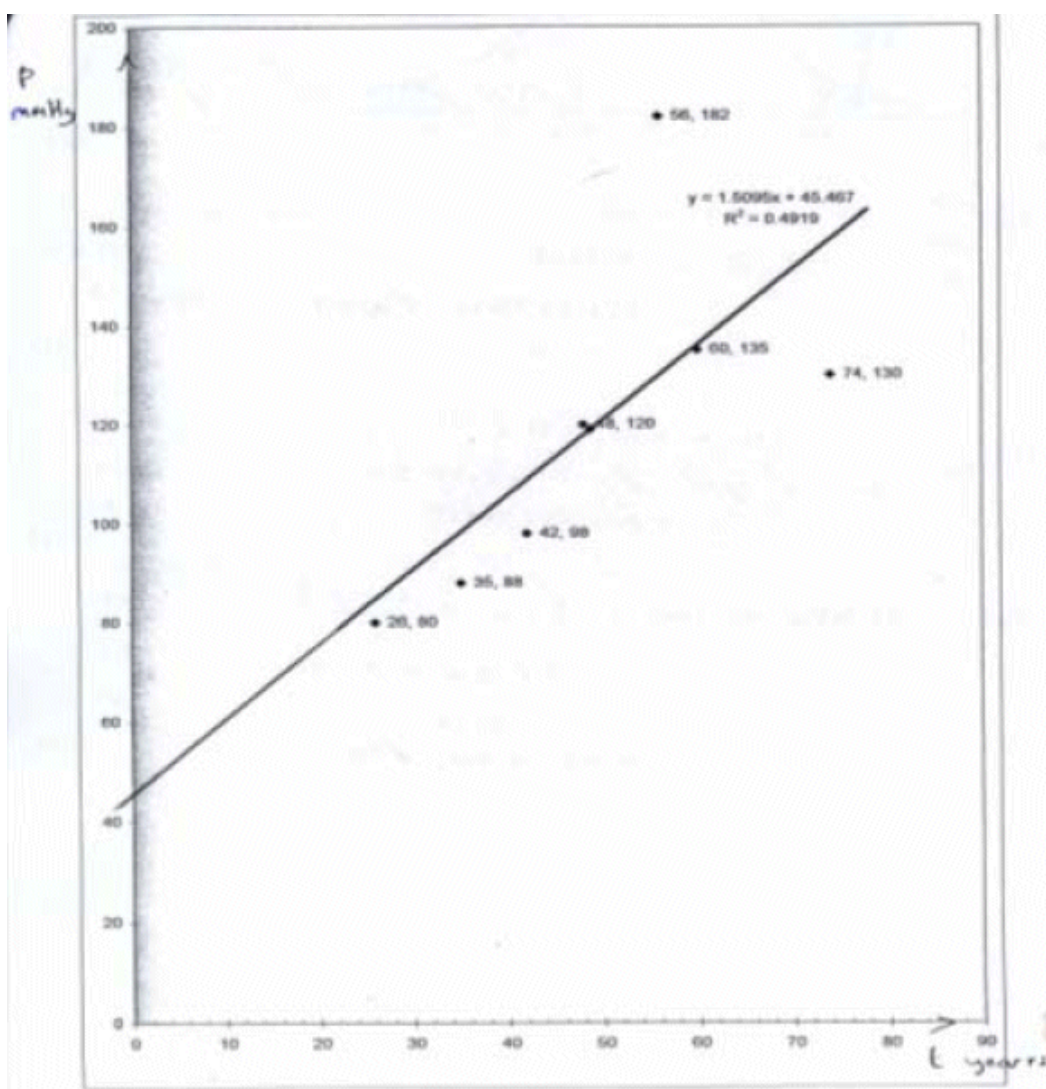
Record 1 point incorrect as B1B0 on open. [NB overlay for (60, 135) is slightly wrong]

(e)	$b = \frac{2369}{1569.42857...} = 1.509466...$	M1	A1	
	$a = \frac{833}{7} - b \times \frac{341}{7} = 45.467413...$		M1	
	$P = 45.5 + 1.51t$		A1	4

Note

- 1st M1 for use of the correct formula for b ,
ft their values from (a)
- 1st A1 allow 1.5 or better
- 2nd M1 for use of $\bar{y} - b\bar{x}$ with their values
- 2nd A1 for full equation with $a = \text{awrt } 45.5$ and
 $b = \text{awrt } 1.51$. Must be p in terms of t ,
not x and y .

(f)	Line drawn with correct intercept, and gradient Diagram for (d) + (f)	B1 ft B1	2
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**Note**

- 1st B1 ft ft their intercept (within one square).
You may have to extend their line.
- 2nd B1 for correct gradient i.e. parallel to given
line (Allow 1 square out when $t = 80$)

- (g) $t = 40, p = 105.84...$ from equation or graph. **awrt 106** M1 A1 2

Note

M1 for clear use of their equation with $t = 40$ or correct value from their graph.

A1 for awrt 106. Correct answer only (2/2) otherwise look for evidence on graph to award M1

[18]

3. (a) $(S_{pp} =) 38125 - \frac{445^2}{10}$ M1
 $= 18322.5$ awrt 18300 A1
 $(S_{pp} =) 26830 - \frac{445 \times 240}{10}$
 $= 16150$ awrt 16200 A1 3

Note

M1 for seeing a correct expression

$$38125 - \frac{445^2}{10} \text{ or } 26830 - \frac{445 \times 240}{10}$$

If no working seen, at least one answer must be exact to score M1 by implication.

- (b) $r = \frac{16150}{\sqrt{18322.5 \times 21760}}$ Using their values
 for method M1
 $= 0.8088...$ awrt 0.809 A1 2

Note

Square root and their values with 21760 all in the right places required for method. Anything which rounds to (awrt) 0.809 for A1.

- (c) As the temperature increases
the pressure increases.

B1 1

Note

Require a correct statement in **context** using temperature/heat and pressure for B1.

Don't allow "as t increases p increases".

Don't allow proportionality.

Positive correlation only is B0 since there is no interpretation.

[6]

4. (a) $Q_2 = 53$, $Q_1 = 35$, $Q_3 = 60$

B1, B1, B1 3

Note

1st B1 for median

2nd B1 for lower quartile

3rd B1 for upper quartile

- (b) $Q_3 - Q_1 = 25 \Rightarrow Q_1 - 1.5 \times 25 = -2.5$ (no outlier)

M1

$$Q_3 + 1.5 \times 25 = 97.5 \text{ (so 110 is an outlier)}$$

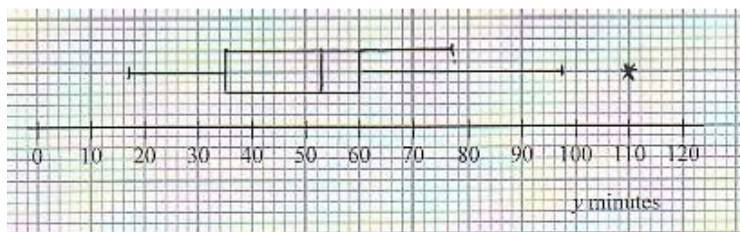
A1 2

Note

M1 for attempt to find one limit

A1 for both limits found and correct. No explicit comment about outliers needed.

- (c)



M1
A1ft
A1ft 3

Note

M1 for a box and two whiskers

1st A1ft for correct position of box, median and quartiles. Follow through their values.

2nd A1ft for 17 and 77 or "their" 97.5 and *. If 110 is not an outlier then score A0 here. Penalise no gap between end of whisker and outlier. Must label outlier, needn't be with *.

Accuracy should be within the correct square so 97 or 98 will do for 97.5

$$(d) \quad \sum y = 461, \sum y^2 = 24219 \therefore S_{yy} = 24219 - \frac{461^2}{10} = 2966.9(*) \quad \text{B1, B1, B1cso} \quad 3$$

Note

1st B1 for $\sum y$ N.B. $(\sum y)^2 = 212521$ and can imply this mark

2nd B1 for $\sum y^2$ or at least three correct terms of $\sum (y - \bar{y})^2$ seen.

3rd B1 for complete correct expression seen leading to 2966.9. So all 10 terms of $\sum (y - \bar{y})^2$

$$(e) \quad r = \frac{-18.3}{\sqrt{3463.6 \times 2966.9}} \text{ or } \frac{-18.3}{3205.64...} = -0.0057$$

AWRT -0.006 or -6×10^{-3} M1 A1 2

Note

M1 for attempt at correct expression for r . Can fit their S_{yy} for M1.

(f) r suggests correlation is close to zero so parent's claim is not justified B1 1

Note

B1 for comment rejecting parent's claim on basis of weak or zero correlation
 Typical error is "negative correlation so comment is true" which scores B0
 Weak negative or weak positive correlation is OK as the basis for their rejection.

[14]

5. (a) (£) 17 Just **17** B1 1

(b) $\Sigma t = 212$ and $\Sigma m = 61$ (Accept as totals under each column in qu.) B1, B1
 $S_{tm} = 2485 - \frac{61 \times 212}{10} = 1191.8$ awrt **1190** or 119 (3sf) M1, A1
 $S_{tt} = 983.6$ (awrt **984**) and $S_{mm} = 1728.9$ (awrt **1730**) (or 98.4 and 173) A1, A1 6
 M1 for one correct formula seen, ft. their $\Sigma t, \Sigma m$
 [Use 1st A1 for 1 correct, 2nd A1 for 2 etc]

$$(c) \quad r = \frac{1191.8}{\sqrt{983.6 \times 1728.9}} \quad \text{M1, A1ft}$$

$$= 0.913922... \quad \text{awrt } \mathbf{0.914} \quad \text{A1} \quad 3$$

M1 for attempt at correct formula, $\frac{2485}{\sqrt{2101 \times 5478}}$

scores M1A0A0

A1 ft. their values for S_{tt} etc from (b) but don't give for $S_{tt} = 5478$ etc (see above)

Answer only (awrt 0.914) scores 3/3, 0.913 (i.e. truncation) can score M1A1ft by implication.

- (d) 0.914 (Must be the same as (c) or awrt 0.914) B1ft ($|r| < 1$)
 e.g. linear transformation, coding does not affect coefficient (or recalculate) dB1 2
 2^{nd} B1 dependent on 1^{st} B1 Accept $\sum m = 261$, $\sum m^2 = 8541$, $\sum tm = 6725 \rightarrow 0.914$
- (e) 0.914 suggests longer spent shopping the more spent.
 (Idea more time, more spent) B1
 0.178 different amounts spent for same time. B1 2
 One mark for a sensible comment relating to each coefficient
 For 0.178 allow "little or no link between time and amount spent".
 Must be in context.
 Just saying 0.914 is strong +ve correlation
 between amount spent and time shopping and 0.178 is weak
 correlation ... scores B0B0.
- (f) e.g. might spend short time buying 1 expensive item OR
 might spend a long time checking for bargains, talking,
 buying lots of cheap items. B1g 1
 B1g for a sensible, practical suggestion showing that other
 factors might affect the amount spent.
 E.g. different day (weekend vs weekday) or time of day
 (time spent queuing if busy)

[15]

6. (a) $S_{xx} = 10164 - \frac{272^2}{8} = 916$ M1,A1
Any one method, cao
- $S_{yy} = 13464 - \frac{320^2}{8} = 664$ A1
cao
- $S_{xy} = 11222 - \frac{272 \times 320}{8} = 342$ A1 4
cao
- (Or 114.5,83 & 42.75)

$$(b) \quad r = \frac{342}{\sqrt{916 \times 664}} = 0.43852$$

M1A1ftA1 3

formula, all correct ($\sqrt{608224}$), 0.439

- (c) Slight / weak evidence,
students perform similarly in pressups and situps
context for +ve

B1
B1 2

$$(d) \quad \bar{x} = \frac{272}{8} = 34$$

M1A1

$$s = \sqrt{\frac{10164}{8} - 34^2} = \sqrt{114.5} = 10.700$$

M1A1 4

method includes $\sqrt{\quad}$, awrt 10.7

OR divisor ($n - 1$) awrt 11.4

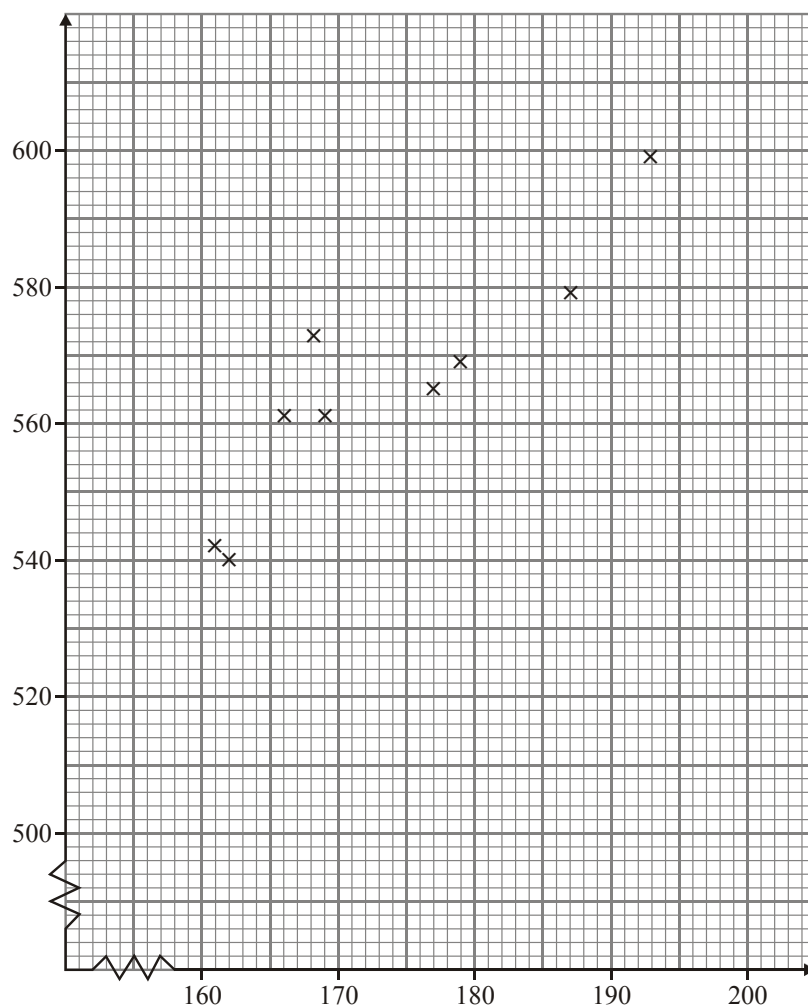
- (e) $a = 1.96 \times 10.700 \dots = 20.9729$ (or 22.4 divisor ($n - 1$))
 $1.96 \times s$, 21.0 or 22.4

1.96B1
M1A1 3

- (f) Pressups discrete, Normal continuous
Not a very good assumption

B1
B1 dep 2**[18]**

7. (a)



Labels (not x, y)
Sensible scales allow axis interchange
Points

B1
B1
B2 4

(-1 ee)

$$(b) \quad S_{hc} = 884484 - \frac{1562 \times 5088}{9} = 1433\frac{1}{3}$$

M1

correct use of S

$$1433\frac{1}{3}; 1433.\dot{3}$$

A1

$$S_{hh} = 1000\frac{2}{9}; S_{cc} = 2550$$

A1; A1 4

$$1000\frac{2}{9}, 1000.\dot{2}; 2550$$

(NB: accept :- 9; i.e.:- $159\frac{7}{27}$; $111\frac{11}{81}$; $283\frac{1}{3}$)

(c) $r = \frac{1433 \frac{1}{3}}{\sqrt{1000 \frac{2}{9} \times 2550}}$	M1		
<i>substitution in correct formula</i>			
$= 0.897488....$	A1 ft A1	3	
<i>AWRT 0.897(accept 0.8975)</i>			
(d) Taller people tend to be more confident <i>context</i>	B1	1	
(e) $b = \frac{1433.\dot{3}}{1000.\dot{2}} = 1.433014....$	M1		
$a = \frac{5088}{9} - \frac{1433.\dot{3}}{1000.\dot{2}} \times \frac{1562}{9} = 316.6256...$	M1		
<i>allow use of their b</i>			
$\therefore c = 317 + 1.43h$ (3sf)	A1	3	
(f) $h = 180 \Rightarrow c = 574.4$ or $574.5683....$ <i>subt. of 180</i>	M1		
$574 - 575$	A1	2	
(g) $161 \leq h \leq 193$	B1	1	
<i>NB (a) No graph paper $\Rightarrow 0/4$</i>			[18]
8. (a) $S_{xy} = 204.95 - \frac{48.1 \times 52.8}{7} = -157.86142$ $S_{xx} = 155.92428$ $S_{yy} = 214.95714$			
<i>correct method</i>	M1		
<i>AWRT – 158/–22.6</i>	A1		
<i>AWRT 156/22.3</i>	A1		
<i>AWRT 215/30.7</i>	A1	4	

(b)
$$r = \frac{-157.86142}{\sqrt{155.92428... \times 214.95714...}}$$

$$= -0.862269... \text{ (awrt } -0.862)$$

SR: No working
 $r = -0.862$
B1 only

M1 A1 ft
A1 3

- (c) (i) -0.862 B1 ft
- (ii) As sales at on petrol station increases, the other decreases;
 limited pool of customers; close one garage B1 2

[9]