



12 Pages

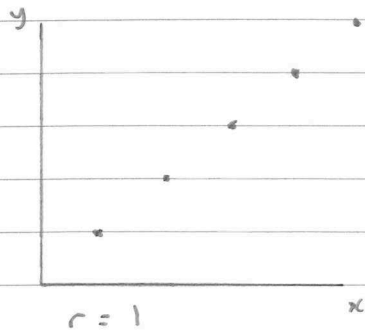
1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	1809804
2	Title of Examination Paper	Eng. Mngt (Elec)
3	Module Code	SGEE 6004
4	Date and Time of Examination	05/05/2023 9:30
5	Examination Venue	College Hall
6	Seat Number	
7	Number of Answer Books handed in	

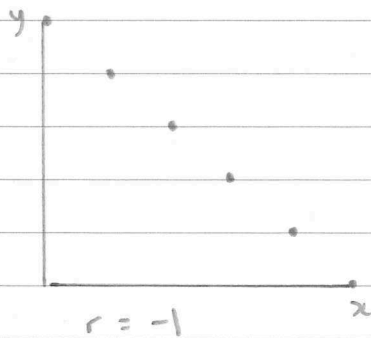
List the numbers of the questions you have attempted	Office Use
2	21
1	10
4	9
3	5
Total	45

Mark confirmed as
45 (KC)

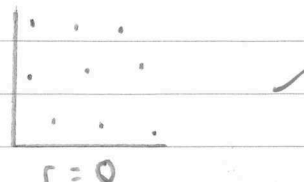
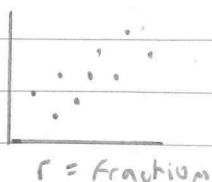
Q2 Direct correlation describes variable moving in the same sense i.e. scrap in a factory increasing therefore cost increasing. The direct correlation diagram is shown below



Inverse ~~(correlation)~~ direct correlation describes variables moving in the inverse sense, i.e. the quantities of products increasing and costs going down. The inverse direct correlation diagram is shown in the diagram below.



The use of the "line of best use" is implemented to forecast future performance. The drawback with this method inaccuracy will always be present. Regression analysis calculates the line of best fit using the $y = mx + c$ formula. This provides the best method of forecasting future performance



2b	X	Y	XY	X ²	Y ²	$\Sigma x = 75$
	3	6.1	18.3	9	37.1	$\Sigma y = 96.8$
	4	7	28	16	49	$\Sigma xy = 788$
	5	7.9	39.5	25	62.41	$\Sigma x^2 = 645$
	6	8.8	52.8	36	77.44	$\Sigma y^2 = 983.73$
	7	9.4	65.8	49	88.36	$N = 10$
	8	9.9	79.2	64	98.01	89
	9	11	99	81	121	✓
	10	11.4	114	100	129.96	
	11	12.2	134.2	121	148.84	
	12	13.1	157.2	144	171.61	

$$m = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{N}}{\Sigma x^2 - \frac{(\Sigma x)^2}{N}}$$

$$m = \frac{788 - \frac{75 \times 96.8}{10}}{645 - \frac{75^2}{10}}$$

$$m = \frac{788 - 726}{645 - 562.5} = 0.751 \checkmark$$

$$c = \frac{(\Sigma x)(\Sigma xy) - (\Sigma y)(\Sigma x^2)}{(\Sigma x)^2 - N(\Sigma x^2)}$$

$$c = \frac{75 \times 788 - 96.8 \times 645}{75^2 - 10 \times 645}$$

$$c = \frac{59100 - 62436}{5625 - 6450}$$

$$c = 4.04 \checkmark$$

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\left[\sum x^2 - \frac{(\sum x)^2}{n} \right] \left[\sum y^2 - \frac{(\sum y)^2}{n} \right]}}$$

$$r = \frac{748 - \frac{75 \times 96.8}{10}}{\sqrt{\left[645 - \frac{75^2}{10} \right] \left[943.73 - \frac{96.8^2}{10} \right]}}$$

$$r = \frac{62}{\sqrt{82.5 \times 46.706}}$$

$$r = 0.999 \quad \checkmark$$

$R^2?$

$$y = 0.751x + 4.04 \quad \checkmark$$

@ 15

$$y = 0.751(15) + 4.04$$

$$y = 15.305 \quad \checkmark$$

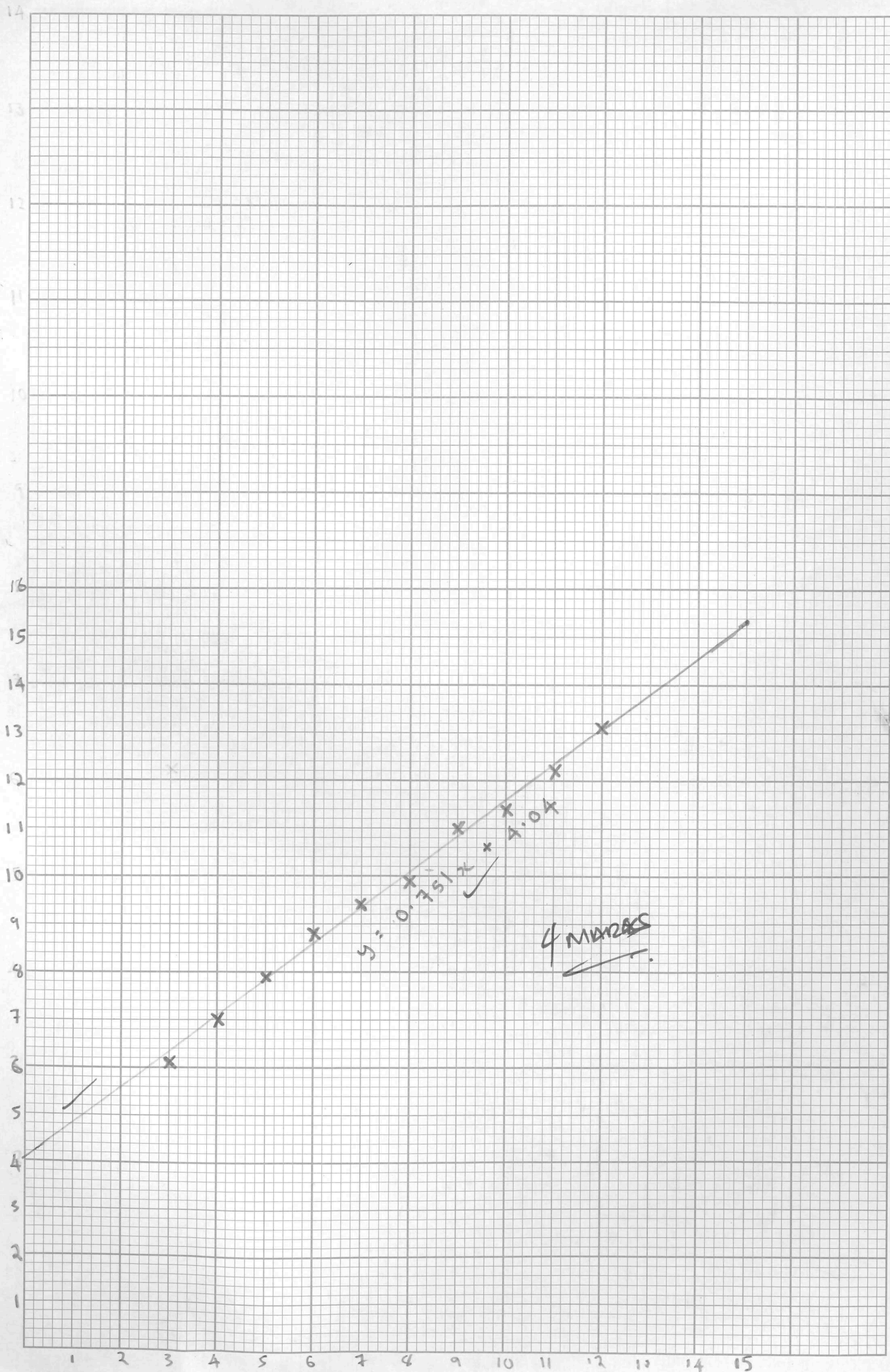
See attached graph paper

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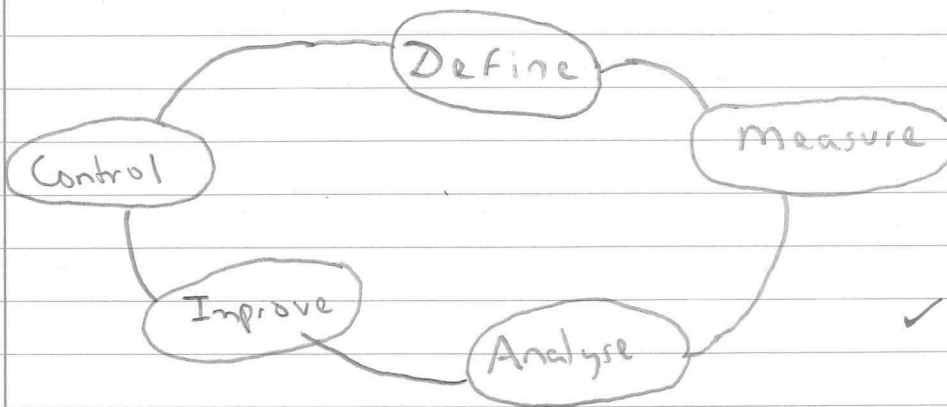
+

4

(18)



1. The DMAIC cycle is shown below



Define

The improvement project must be defined with customer and process requirements i.e. input, output, control, resource. ✓

Measure.

The current process performance must be established and process capability ✓ must be calculated.

Analyse

The current process is evaluated and problem and root causes are ✓ analysed.

Improve.

The improvements are implemented in the process and the results are analysed. ✓

Control

The implementation are set in working instruction and inspected. ✓

The six sigma philosophy incorporates several benefits however there are disadvantages.

Six sigma provides a systematic approach. ✓

The philosophy engenders individuals and improves productivity. ✓ The problem definition and measurable parameter enable the monitoring and analysis of the improvement project. ✓

Six sigma training is expensive. ✓ Once employees are trained competition companies ✓ will endeavour to ~~poach~~ steal them. Therefore staff retention can be challenging. ✓ The statistical nature of six sigma can take away from simple ✓ lean manufacturing philosophies such as 5s, that can provide improvements. ✓

(10)

4 Total preventative maintenance defines performance as machine availability. ✓ TPM puts an emphasis on preventative measures to keep machine in production.

TPM measures include

Establishing the mean time between failure (MTBF) ✓
Improving the MTBF. ✓

Establishing a planned preventative maintenance ✓
schedule. TPM supports increased productivity and efficiency by keeping machine running time to a maximum and performing preventative work when the machine is down. TPM incorporates modern technology to ~~assess~~ assess machine health such as vibration analysis. TPM provides autonomous teams to clean and maintain machine. ✓

The breakdown maintenance approach requires intervention only when the machine breakdowns. ✓

This approach only deals with breakdowns as they occur. This incurs decreased productivity ✓ and efficiency as unplanned maintenance takes significantly longer to resolve than planned work. ✓

* TPM endeavours to make machines as maintainable as possible. ✓

3a) Internal quality failures include the production of products out of specification. ✓

External quality failures include the failure to comply with legislation. ✓

3b) The total quality management hierarchy incorporates quality assurance, quality control, quality of conformance and inspection.

TQM

A ~~whole~~ holistic approach to the quality of ✓
a product or/and process.

QA

To ensure the product ~~quality~~ or/and process, is within standard

QC

To ensure the product/ ~~and~~ process quality and measures such as PPM are maintained to a good standard. ✓

Inspection

Inspection includes internal and external inspection to ensure conformity to standards. ✓