

**Modified Enlarged 18 pt**

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Thursday 15 June 2023 – Morning**

**Level 3 Cambridge Technical in Engineering**

**05873**

**Unit 24: Project management for engineers**

**Time allowed: 2 hours plus your additional time allowance**

**You must have:  
a calculator**

**Please write clearly in black ink.**

**Centre  
number**

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**Candidate  
number**

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**First name(s)** \_\_\_\_\_

**Last name** \_\_\_\_\_

**Date of  
birth**

D	D	M	M	Y	Y	Y	Y
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**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS**

**Use black ink. You can use an HB pencil, but only for graphs and diagrams.**

**Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.**

**Answer ALL the questions.**

## **INFORMATION**

**The total mark for this paper is 80.**

**The marks for each question are shown in brackets [ ].**

## **ADVICE**

**Read each question carefully before you start your answer.**

**BLANK PAGE**

**TEXT 1**

**Sykes Components Ltd is a British manufacturer of plastic components; it uses computer-aided design (CAD) software coupled with modern injection moulding processes to produce custom-made parts for the automotive industry.**

**Zac Sykes formed the company in 2002. The company now has three directors, including Zac its Managing Director, who is a leading member of the UK Injection Moulding Society. This is a prestigious trade organisation which seeks to promote innovation in the plastics industry.**

**Employing 37 people, the company uses three different production processes, each with their own production cells.**

**GAIM (Gas assisted injection moulding) × 6 cells.**

**A fast process for producing hollow components or ones with complex shapes, e.g. car door handles and fuel level sensors.**

**MMIM (Multiple material injection moulding) × 2 cells.**

**A process used when two or more materials with different properties are needed, e.g. soft touch CD buttons or arm rests.**

**RIM (Reaction injection moulding) × 4 cells.**

**A slower process which produces lightweight but solid components, e.g. steering wheels and bumpers.**

**Sykes Components Ltd has a reputation for excellence in design and for the production of superior, high precision, components. However, this level of customer service and quality comes at a high price.**

**In recent years production costs have been too high and company profits have been falling. An investigation found that the use of robots to load and unload the cells would cut production times and lower wastage, thus reducing production costs.**

**This matter is now urgent. A new project has been commissioned. The required deliverables are three robots (one to serve each of the three production processes). The objective is to reduce overall production cost by at least 3.5%. The three directors comprise the project board.**

**Nina Dixon, the company's newly appointed Robotics Engineer, has been assigned as project manager. Nina was recruited straight from university and has a degree in robotic engineering. Nina is keen to do well in her first job. She is not a born leader, however, and is risk averse. She has never been part of a project before, nor has she been trained in project management.**

**The managers of each of the three production processes have been assigned as project team members. All are fully qualified engineers who have worked for the company for many years:**

**Kofi (GAIM) – approaching retirement, prefers traditional production methods, dislikes robotics**

**Jamal (MMIM) – eager to change, but busy preparing to speak at an engineering conference**

**Amir (RIM) – project manager last year, is disappointed not to be project manager again.**

**1 REFER TO TEXT 1.**

- (a) Explain ONE benefit to Nina of reading company documentation from previous projects before managing this project.**

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**[2]**

- (b) Explain ONE purpose of each of the following plans that Nina needs to produce: [6]**

**resource plan**

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**quality plan**

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**project schedule.**

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**(c) Discuss THREE leadership styles that Nina could use to manage this project.**

**Which ONE of these leadership styles should Nina use? Justify your view. [12]**

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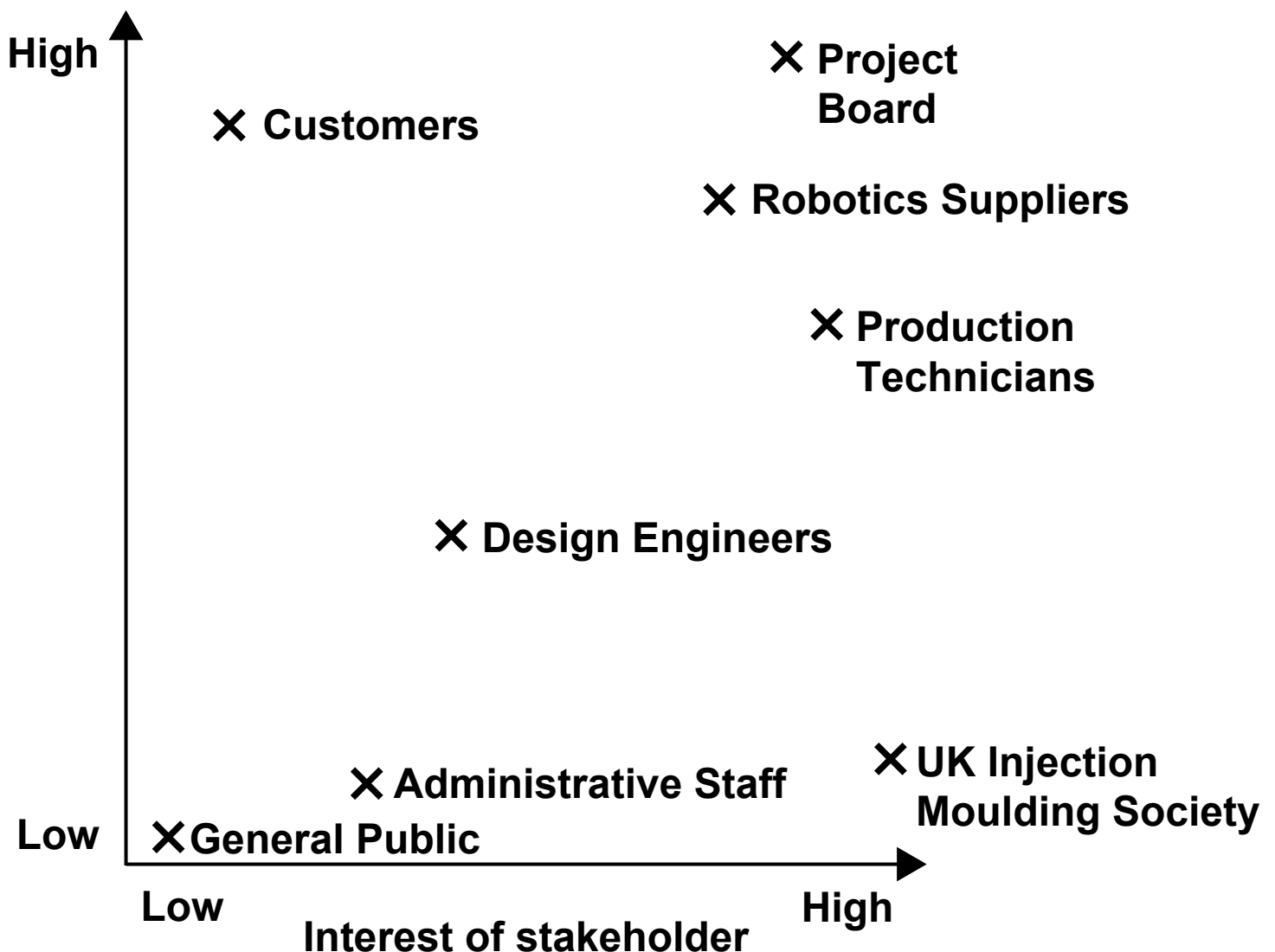
**TEXT 2**

Nina is considering how to manage the project's stakeholders. A graph showing the levels of power and interest of project stakeholders is shown in FIG. 1.

**FIG. 1**

**Graph showing project stakeholders according to their levels of power and interest**

**Power of stakeholder**





## 2 REFER TO TEXT 2.

- (a) FIG. 1 shows the power and interest levels of internal and external stakeholders.

Complete the unshaded cells in the table below to advise Nina how to manage each of the four EXTERNAL stakeholders shown in FIG. 1. [12]

External stakeholder		Level of power? (high, medium or low)	Level of interest? (high, medium or low)	How should this external stakeholder group be managed?
1				
2				

External stakeholder		Level of power? (high, medium or low)	Level of interest? (high, medium or low)	How should this external stakeholder group be managed?
3				
4				

- (b) Nina realises that an effective project manager needs to be able to motivate the team.

Analyse TWO ways Nina could motivate her project team members.

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**TEXT 3**

**Nina is aware of her inexperience in planning, managing and monitoring a project.**

**Nina intends to use PERT to estimate the expected duration of the project.**

**Her calculations suggest that:**

**‘most likely time’ = 8 months**

**‘optimistic time’ = 6 months**

**She is unsure what figure to use for ‘pessimistic time’.**

**Nina also intends to use a series of Gantt charts to help monitor the project.**

**3 REFER TO TEXT 3.**

- (a) Nina is considering whether to set the ‘pessimistic time’ for PERT to 16 months or to 28 months.**

**Calculate, using PERT, by how much the estimated expected duration of the project would increase if Nina used a ‘pessimistic time’ of 28 months rather than 16 months. [7]**

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**(b) State ONE benefit to Nina of using Gantt charts to monitor the project.**

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**[1]**

(c) Details of the activities in the implementation stage of the project are shown in TABLE 1, below.

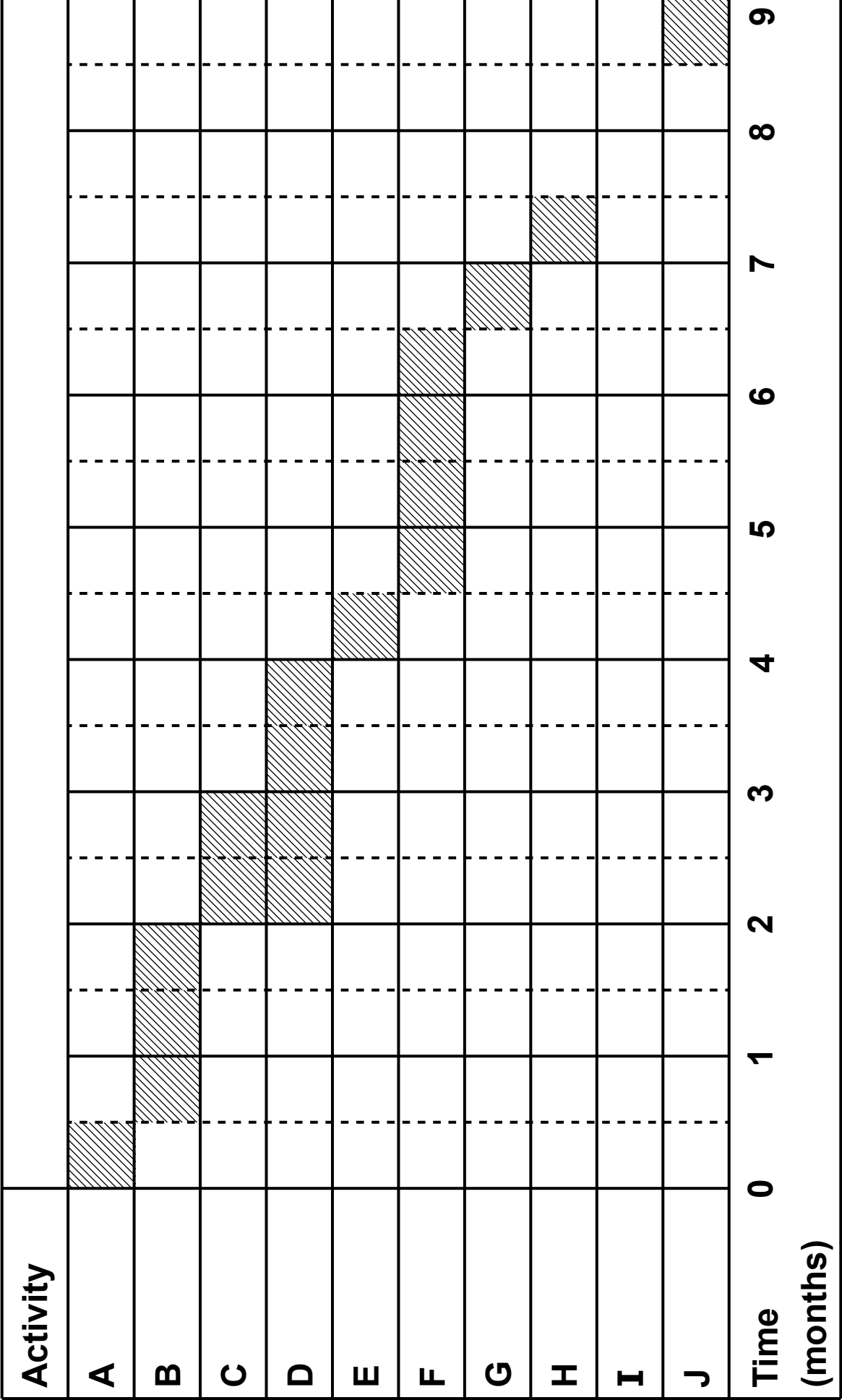
**TABLE 1**

<b>Activity</b>	<b>Description</b>	<b>Dependent activities*</b>	<b>Duration of activity (months)</b>
<b>A</b>	<b>Kick-off meeting to agree parameters</b>		<b>0.5</b>
<b>B</b>	<b>Assess technical feasibility</b>	<b>A</b>	<b>1.5</b>
<b>C</b>	<b>Finalise functionality specifications</b>	<b>B</b>	<b>1</b>
<b>D</b>	<b>Negotiate with robotic suppliers</b>	<b>B</b>	<b>2</b>
<b>E</b>	<b>Select preferred robotic supplier and confirm order</b>	<b>C, D</b>	<b>0.5</b>
<b>F</b>	<b>Lead time for supply of three robots</b>	<b>E</b>	<b>2</b>
<b>G</b>	<b>Delivery, installation and commissioning of robots</b>	<b>F</b>	<b>0.5</b>
<b>H</b>	<b>On-the-job training of production technicians</b>	<b>G</b>	<b>0.5</b>
<b>I</b>	<b>Live testing of robots in GAIM, MMIM and RIM</b>	<b>H</b>	<b>1</b>
<b>J</b>	<b>Give feedback to supplier and confirm obligations</b>	<b>I</b>	<b>0.5</b>

\* Finish to start dependency – activity to start when predecessor finishes.

Nina has produced a Gantt chart for the implementation stage of the project, see FIG. 2, opposite.

FIG. 2



Key:  = activity time  = slack time

- (i) Complete the Gantt chart, FIG. 2 on the previous page, by:
- shading in the activity time for 'Activity I: Live testing of robots in GAIM, MMIM and RIM'
- shading in the slack time for 'Activity C: Finalise functionality specifications'. [2]
- (ii) Nina thinks that 'Activity C: Finalise functionality specifications' is a critical activity.
- Explain whether Nina is correct.

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[2]

- (iii) Nina knows that depending on which supplier is chosen, the duration of 'Activity F: Lead time for supply of three robots' may need to be adjusted.
- Calculate the minimum completion time for the implementation stage of the project if the duration of 'Activity F: Lead time for supply of three robots' needs to be increased to 5 months.

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[2]

- (d) Nina is concerned about a number of factors that could significantly affect the outcome of the project.

In the table below, identify with a tick (✓) whether these factors are internal factors or external factors.

You should only place ONE tick in each row. [4]

Factor	Internal factor	External factor
Nina's own lack of skills as a project manager		
Sykes Components Ltd's policies and procedures		
Market dynamics in the robotics industry		
The scope of the project		

- (e) Identify ONE control technique that could help Nina keep the project on track.

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[1]

**TEXT 4**

Sykes Components Ltd's preferred robotic supplier is The Kaashawi Corporation in Japan. Nina had insisted that any purchase be subject to a free exchange if the model failed to deliver the required cost reductions during testing. The Kaashawi Corporation was the only supplier willing to agree to this requirement.

The Kaashawi Corporation has worked alongside Sykes Components Ltd's engineers to help them understand the capabilities of its range of robots. Sykes Components Ltd eventually chose model CH6P, a compact high-performance robot. The CH6P robot is capable of servicing the production cells at high speed across 6-axes, with a tolerance of less than 0.02 mm. The combined cost for three CH6P robots is £150 000. The purchase has been funded by debt finance.

The three CH6P robots are currently being tested.

**4 REFER TO TEXT 4.**

(a) State what is meant by the term 'debt finance'.

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[1]

(b) 'Activity I: Live testing of robots in GAIM, MMIM and RIM' is now complete. Cost data for before and after the introduction of the three robots is shown in the table below.

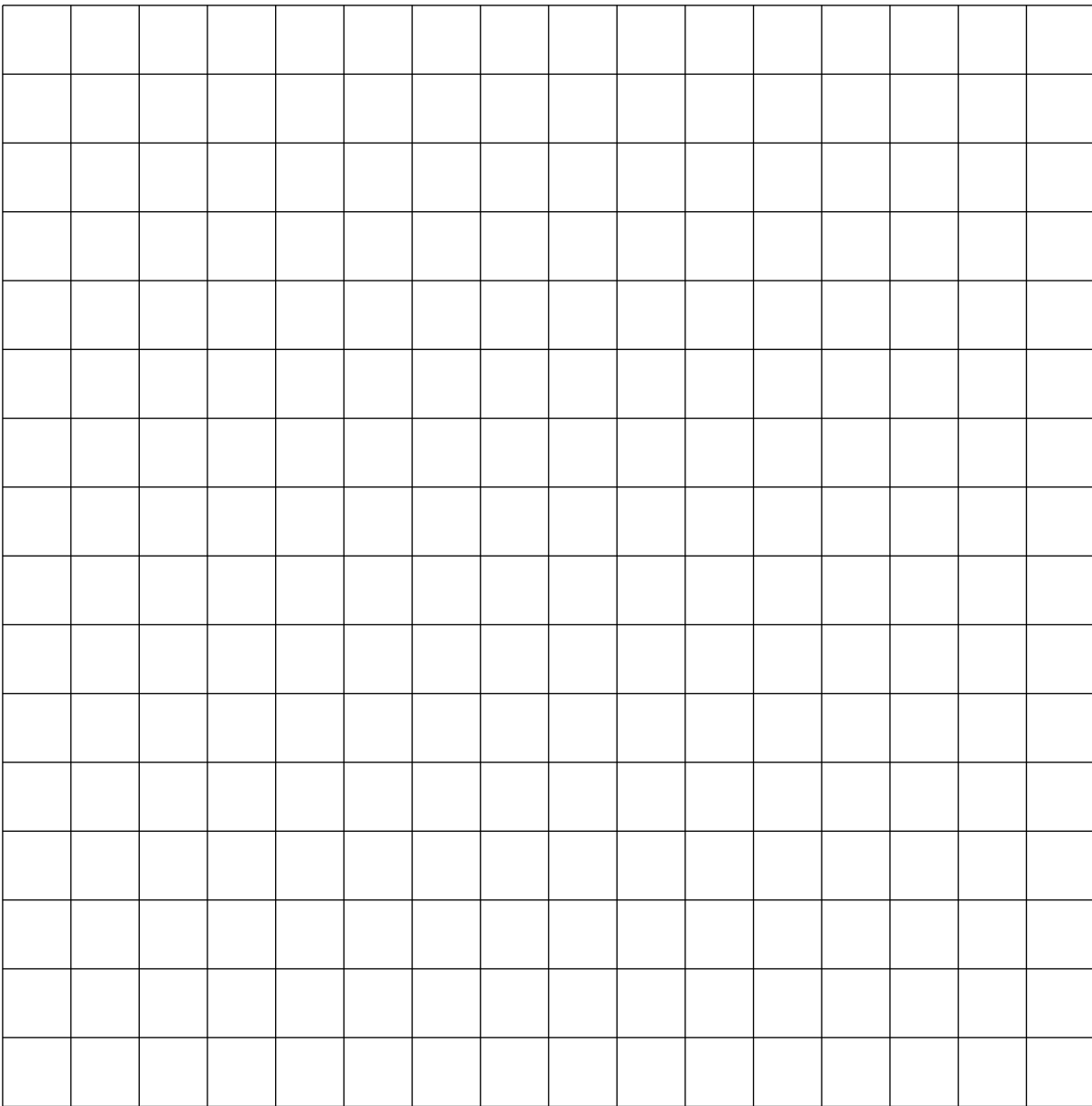
(i) Complete the '% reduction in average unit cost' column in the table below.

Give your answers correct to one decimal place. [3]

<b>Production process</b>	<b>Average unit cost of production <u>before</u> the introduction of robot CH6P</b>	<b>Average unit cost of production <u>after</u> the introduction of robot CH6P</b>	<b>% reduction in average unit cost (correct to 1 d.p.)</b>
<b>GAIM</b>	<b>2p</b>	<b>1.88p</b>	
<b>MMIM</b>	<b>16p</b>	<b>15.44p</b>	
<b>RIM</b>	<b>150p</b>	<b>148.50p</b>	

- (ii) Produce a bar chart for Nina to include in the final project report. The bar chart should show the percentage cost reduction achieved for each of the three production processes.

You should draw, and fully label, your bar chart on the graph paper below. Use a scale that demonstrates the required degree of accuracy. [3]





- (iii) State whether the objective to reduce the company's overall production cost by at least 3.5% was achieved during the month of testing, or whether more information is required before this can be determined. Justify your answer.**

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[3]

- (c) Project monitoring has revealed an adverse variance on the budget spend for the three robots.

Identify TWO economic factors that may have affected the outcomes of the project.

For each factor, explain how it may have contributed to this adverse variance. [6]

**Economic factor 1**

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**Contribution to adverse variance**

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**Economic factor 2**

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**Contribution to adverse variance**

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(d) At project closure Nina intends to collect as much feedback as possible.

(i) Identify the types of feedback shown in the table below.

Show your answer by circling your choices.

You should only draw ONE circle in each row. [3]

Feedback	Type of feedback	
Opinions of project board members	Objective	Subjective
Issue logs	Objective	Subjective
The reputation of Sykes Components Ltd as perceived by the UK Injection Moulding Society	Objective	Subjective

- (ii) Identify ONE formal method which Nina could use to obtain feedback from the company's production technicians.

Explain ONE advantage to Nina of using this method.

Method \_\_\_\_\_

Advantage \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[3]

- (iii) Identify ONE reason why it is important to review lessons learned at the end of a project.

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[1]

**END OF QUESTION PAPER**

### ADDITIONAL ANSWER SPACE

**If additional answer space is required, you should use the following lined pages. The question numbers must be clearly shown – for example, 1(c) or 4(b)(iii).**

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