

Cambridge **TECHNICALS LEVEL 3**

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ENGINEERING

Unit 17

Computer Aided Manufacturing
(CAM)

Model assignment

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Please note:

You can use this assignment to provide evidence for summative assessment, which is when the learner has completed their learning for this unit and is ready to be assessed against the grading criteria.

You can use this assignment as it is, or you can modify it or write your own; we give more information in this document under Guidance for tutors.

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Guidance for tutors on using this assignment

General

OCR Cambridge Technical model assignments are available to download from our website:

www.ocr.org.uk.

The purpose of this assignment is to provide a scenario and set of tasks that are typical of how engineers would use Computer Aided Manufacturing (CAM) tools, to enable you to assess your learner against the requirements specified in the grading criteria. The scenario and its tasks are intended to give a work-relevant reason for applying the skills, knowledge and understanding needed to achieve the unit.

This assignment will not instruct learners how to meet the highest grade. Whether learners achieve a pass, merit or distinction will depend on what evidence they produce.

You can modify the scenario we provide in this assignment to make it more relevant to your local or regional needs. Please refer to the information under 'Modifying the model assignment' later in this section.

You don't have to use this assignment. You can use it as a guide to help you to design your own assignment, and we provide an assignment checking service. You'll find more information on these matters in section 8 of the qualification handbook.

In the tasks, we'll refer to the format of evidence. Learners are **not** required to follow that format **unless** we tell them otherwise.

It's essential that the work every learner produces is their own. Please make sure you read through the information we give on authenticity in section 8 of the qualification handbook and make sure that your learners and any staff involved in assessment understand how important authenticity is.

We provide this assignment to be used for summative assessment. You must not use it for practice or for formative assessment.

Before using this assignment to carry out assessment

Learners will need to take part in a planned learning programme that covers the knowledge, understanding and skills of the unit.

When your learners are ready to be assessed, they must be provided with a copy of the following sections of this assignment:

- General information for learners
- Assignment for learners
- Evidence Checklist

They may carry out preparation prior to undertaking the tasks and there is no time limit for this.

When completing the assignment

You should use this assignment in conjunction with the unit specification and qualification handbook.

Information to support the scenario/tasks

The geometry of the component design(s) given in the scenario (Fig.1 and Fig.2) can be modified to more appropriately suit the machinery, tooling or material available at your centre.

The component designs given illustrate the types of operations and complexity of component that should be produced at this level. Two designs have been supplied, a more advanced mounting block component for CAD/CAM simulation (Fig.1) and a simpler 2D profile (Fig.2) that can be used for manual programming techniques.

Resources to complete the tasks

There are resource requirements for this assignment. Every learner will need access to the following resources:

- For task 1 learners will need access to information for research purposes where they can gather information on the use of computers in manufacturing systems. This could be internet based but it is also advantageous for learners to have access to literature or written sources.
- For task 2 learners will need access to a CNC, CAD/CAM simulation system. This could be proprietary software supplied with a CNC machine or CAD/CAM software.
- For task 3 learners will need access to a CNC machine, tooling and material in order to produce the required components.
- For task 4 learners will need access to an additive manufacturing machine e.g. a 3D printer and CAD software to export STL geometry.

Health and Safety and the use of resources

Tutors must ensure that learners are supervised and monitored at all times when using machinery. This assignment requires learners to use CNC and additive manufacturing machines. Tutors must ensure all risk assessments; safe operating procedures and safety precautions including PPE are in place before allowing learners to use machinery. Refer to the operating manuals for specific machinery and ensure staff are appropriately trained and skilled in the operation of all equipment being utilised.

Time

You should plan for learners to have 13–17 hours to complete this assignment.

Learners must be allowed sufficient time to complete all the tasks. The amount of time may vary depending on the nature of the tasks and the ability of individual learners. To help with your planning, against each of the tasks we've given an indication of how long it should take.

Learners can produce evidence in several sessions.

Format of evidence

Learners have to produce evidence that demonstrates how they have met the grading criteria. At the very least they must produce evidence that meets **all** of the pass criteria.

Please make sure your learners realise that missing just one pass criterion means they will not pass the unit, even if they have successfully met the merit and distinction criteria.

- We don't have specific requirements for the format of evidence in this assignment. We've said what format the evidence could take for each task. For example, if we say 'You could include a report on ...', the evidence doesn't have to follow any specific reporting conventions. You can modify the format of the evidence, but you must make sure the format doesn't prevent the learner from accessing the grading criteria.
- It's possible that certain formats for evidence can naturally cover several grading criteria and avoid the need for excessive amounts of evidence. For example, a report can be a good way to pull together evidence to meet several grading criteria.

For more guidance on generation and collection of evidence, please refer to the section 8 'Internal Assessment', in the qualification handbook.

Group work

This assignment hasn't been written to include group work. If you plan to ask learners to work in a team to complete work for assessment, you need to determine at which point in an assessment task learners can work together.

You must be sure that each learner can produce evidence of their own contribution to each grading criterion. You can give constructive feedback to learners about working as a group and direct them on team working skills because evidence of team working skills is not required by the unit. See our information on authentication, including group work and feedback to learners, in section 8 of the qualification handbook.

If witness statements are used to support learners' evidence, you'll need to complete an individual statement for each learner.

After completing the assignment

Once the learner has submitted their work to you to be assessed, you must judge or 'mark' the work against the grading criteria for the unit and identify one grade for the unit. For further information about assessment, please refer to section 8 of the qualification handbook.

Your assessment decisions must be quality assured across the cohort of learners in your centre who are being entered for the same unit. This must be done through an internal standardisation process. We give information on internal assessment and standardisation in the qualification handbook.

Reworking the assignment

If you and the learner feel they've not performed at their best during the assessment, the learner can, at your discretion, improve their work and resubmit it to you for assessment. If a learner is working on improving their work before it is resubmitted, you and the learner must continue to make sure the work is the learner's own.

Any feedback you give to the learner must not direct them on how to improve their work. You can identify what area of the work could be improved but you cannot give the learner any details about how they could improve it. You must follow the guidelines given in section 8 of the qualification handbook under 'Authenticity of learner work'.

Modifying the model assignment

The tasks in this assignment allow learners access to the full range of grades detailed in the grading criteria of this unit.

If you modify this assignment you must **not** change the grading criteria provided in the tasks for the learner or in the evidence checklist. These grading criteria are taken from the unit.

You can modify the scenario to suit your local or regional needs and the tasks may be contextualised to match any changes you have made to the scenario. If you supply your own component, use the component designs given in the scenario as a guide on the types of operations and complexity of the component that should be produced at this level. Drawings provided to support a different scenario must be sufficiently detailed for learners to complete the tasks.

You can modify the type of evidence and the format it takes, unless we expressly state that evidence must take a specific format.

You must also make sure that you avoid discrimination, bias and stereotyping and support equality and diversity. For more information, please see the section 'Designing your own assignments for internally assessed units' in section 8 of the qualification handbook.

If modifications are made to the model assignment, whether to the scenario alone, or to both the scenario and individual tasks, it's your responsibility to make sure that all grading criteria can still be met and that learners can access the full range of grades.

If you're using this model assignment and delivering the Foundation Diploma or Diploma you have an opportunity to secure meaningful employer involvement by working with an employer to modify it.

General information for learners

Q *What do I need to do to pass this assignment?*

A You need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to. If you miss just one pass criterion, you will not achieve this unit and will receive an unclassified result.

Q *What do I need to do if I want to get a merit or distinction for this assignment?*

A For a merit, you need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to **and** you need to produce evidence to meet **all** the merit criteria.

For a distinction, in addition to the above, you also need to meet **all** the distinction criteria for this unit.

Q *What help will I get?*

A Your tutor will support you when completing this assignment and will make sure that you know what resources or facilities you need and are allowed to use. We've given your tutor information about how much support they can give you.

Q *What if I don't understand something?*

A It's your responsibility to read the assignment carefully and make sure you understand what you need to do and what you should hand in. If you are not sure, check with your tutor.

Q *I've been told I must not plagiarise. What does this mean?*

A Plagiarism is when you take someone else's work and pass this off as your own, or if you fail to acknowledge sources properly. This includes information taken from the internet.

It's not just about presenting a whole copied assignment as your own; you will also be plagiarising if you use the ideas or words of others without acknowledgement, and this is why it's important to reference your work correctly (see Q&A below for more information on referencing).

Plagiarism has serious consequences; you could lose the grade for this unit or you may not be allowed to achieve the whole qualification.

Always remember that the work you produce must be your own work. You will be asked to sign a declaration to say that it is.

Q *What is referencing and where can I find out more information about it?*

A Referencing is the process of acknowledging the work of others. If you use someone else's words and ideas in your assignment, you must acknowledge it, and this is done through referencing.

You should think about why you want to use and reference other people's work. If you need to show your own knowledge or understanding about an aspect of subject content in your assignment, then just quoting and referencing someone else's work will not show that **you** know or understand it. Make sure it's clear in your work how you are using the material you have referenced **to inform** your thoughts, ideas or conclusions.

You can find more information about how to reference in the [The OCR Guide to Referencing](http://www.ocr.org.uk/i-want-to/skills-guides/) available on our website: <http://www.ocr.org.uk/i-want-to/skills-guides/>.

Q **Can I work in a group?**

A Yes. However, if you work in a group at any stage, you must still produce work that shows your individual contribution. Your tutor can advise you how to do this.

Q **Does my work for each task need to be in a particular format?**

A You can present your work in a variety of ways – it can be handwritten, word-processed, on video or in digital media. What you choose should be appropriate to the task(s) and your tutor can advise you. There may be times when you need proof that you have completed the work yourself: for example, if you do something during work placement that you want to use as evidence, the tutor might ask the employer to provide a witness statement.

Make sure you check the wording in each task carefully. For each task, we'll tell you if your evidence has to be in a specific format:

- If we say use the word '**must**', for example 'You must produce a report' or 'Your evidence/work must include a diagram', then you must produce the work in the stated format.
- If we use the word '**could**', for example 'You could include sketches of your ideas' or 'You could do this by annotating your diagram', this means that you are not required to follow the format we have given, but you must make sure that the work you do produce allows you to demonstrate the requirements of the grading criteria.

If you are unsure about what evidence you need, please ask your tutor.

Q **Can I ask my tutor for feedback on my work?**

A Yes, but they can't give you detailed feedback.

We have given your tutor instructions on what kind of feedback they can give you. For example, they are **not** allowed to tell you exactly what to do to make your work better, but they **can** remind you about what they've taught you and you can use this additional learning to try and improve your work independently. They can say what they've noticed might be wrong with your work, for example if your work is descriptive where an evaluation is required, but your tutor can't tell you specifically what you need to do to change it from a description to an evaluation – you will need to work out what you need to do and then do it for yourself.

Q **When I have finished, what do I need to do?**

A If you have included the personal details (such as name, address or date of birth) of someone other than yourself in your work, this must be blanked out (anonymised) – your tutor will tell you how to do this. You don't need to do this for information contained in references.

You can complete the evidence checklist to show your tutor where they can find the evidence for each grading criterion in your work.

You should make sure your work is labelled, titled and in the correct order for assessing.

Hand in the work that you've completed for each task to your tutor. They might ask to see your draft work, so please keep your draft work in a safe place.

Q **How will my work be assessed?**

A Your work will be marked by someone in your centre who has been authorised to do so. They will use the information in the grading criteria to decide which grade your work meets. The grading criteria are detailed in each unit and are also given in the tasks within this assignment. Please ask your tutor if you are unsure what the grading criteria are for this assignment.

Assignment for learners

Unit 17: Computer Aided Manufacturing (CAM)

Scenario

Computer Aided Manufacturing (CAM)

CAM Solutions Ltd manufacture components for a wide range of industries using Computer Aided Manufacturing (CAM) techniques. The company specialises in producing high-quality components in large quantities through the use of CAM techniques.

A current client of CAM Solutions Ltd has asked them to investigate the production of a new component design. The client would like CAM Solutions Ltd to investigate the application of computers in manufacturing and explore multiple production methods for a mounting block component including CNC and additive manufacturing techniques. The client has also asked CAM Solutions Ltd to analyse, assess, and evaluate the benefits of each method. The mounting block component design(s) are shown below:

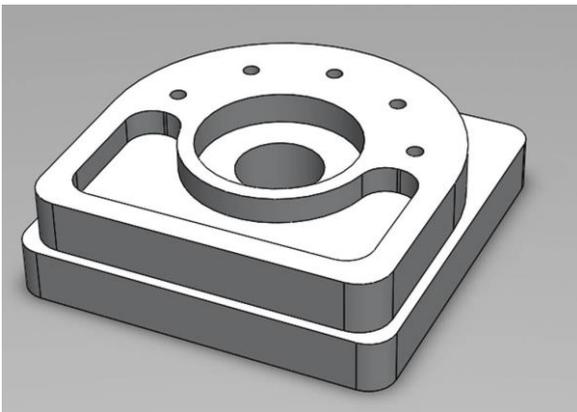


Fig.1 Mounting block component

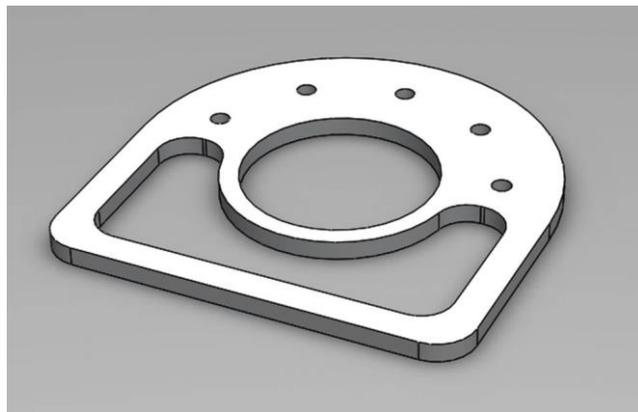


Fig.2 Mounting block profile

Full dimensional details of the components can be found in the 2D engineering drawing supplied in the appendixes.

Using the 2D engineering drawing of the mounting block, you will need to produce components through CAM techniques. As an overview, you will:

- explore how computers are used in manufacturing systems
- produce a CNC program for the production of the mounting block components
- produce mounting block components using CNC techniques
- produce a mounting block component using additive manufacturing techniques.

CAM Solutions Ltd has also asked you to produce a report on the advantages, effectiveness and applications of CAM techniques for the production of components.

You will present your program, produced components and report to the engineering manager.

Task 1: *Investigate how computers are used in manufacturing systems*

(This task should take between 2-3 hours.)

Learning Outcome 1: 'Understand how computers are used in manufacturing systems' is assessed in this task.

Your task is to research how computers are used in manufacturing systems and produce a report for the engineering manager to present to the client.

Your report should include an explanation of how computers are used, and an analysis of the advantages of using computers in manufacturing.

Pass	Merit	Distinction
P1: Explain how computers are used in manufacturing systems.	M1: Analyse the advantages of using computers in manufacturing.	
Evidence		
Your report can be a written document or a presentation with detailed speaker notes. You do not need to practically explore the applications for this task, although you may include reference to some of the examples studied in other elements of this unit to illustrate the findings in your report.		

Task 2: Produce CNC programs for the manufacture of components

(This task should take between 5 and 6 hours.)

Learning Outcome 2: 'Be able to produce CNC programs for the manufacture of components' is assessed in this task.

Your task is to produce a CNC program using manual techniques for the production of the mounting block profile (Fig.2). Produce a CNC program using CAD/CAM techniques for the production of the 3D mounting block component (Fig.1). You must ensure you use mathematical calculations to produce your part programs.

Following the production of your components you should produce a written report that analyses the advantages of using CAD/CAM software rather than manual programming techniques.

Pass	Merit	Distinction
P2: Plan the production of a CNC machined component.	M2: Produce a CNC part program using CAD/CAM software.	D1: Analyse the advantages of the use of CAD/CAM software rather than manual programming techniques for a CNC machined component.
P3: Produce a CNC part program utilising manual programming techniques.		
P4: Use mathematical calculations to produce accurate part programs for use within a CNC machine.		
Evidence		
<p>You must show the process by which you have arrived at the production of the CNC programs.</p> <p>This must include:</p> <ul style="list-style-type: none"> • a production plan for the CNC machined components • a written, printed copy or screen shot of the CNC program produced using manual techniques including mathematical calculation. <p>This should include :</p> <ul style="list-style-type: none"> • a printed copy of the CNC program produced using CAD/CAM software • a written report that analyses the advantages of using CAD/CAM software rather than manual programming techniques. 		

Task 3: Produce components using CNC machines

(This task should take between 3 and 4 hours.)

Learning Outcome 3: 'Be able to set-up and operate a CNC machine to produce components' is assessed in this task.

Your task is to set-up and operate a CNC machine to produce the 2D mounting block profile and the 3D mounting block components. You should subsequently check the accuracy of the components against the 2D engineering drawings of the mounting block components. You should also evaluate the effectiveness of the machining process with recommendations for possible improvements.

Pass	Merit	Distinction
P5: Set-up and operate a CNC machine to produce components.	M3: Prove the accuracy of a machining process by checking a final result against a specification.	D2: Evaluate the effectiveness of the Computer Aided Manufacturing (CAM) process used and make recommendations for possible improvements.
Evidence		
<p>You must show the process by which you have arrived at the production of the CNC machined component(s).</p> <p>This could be presented as an electronic or paper-based report that illustrates the process you have undertaken including, imagery, photographs of the machine set-up, process, finished components and inspection. This should include supporting commentary and evaluation which provides evidence of the tools, techniques and processes that have been used.</p> <p>Your evidence could include:</p> <ul style="list-style-type: none"> • A log of imagery with commentary illustrating the process undertaken to set-up the machine • Photographs of the completed components • Photographic evidence of measurement or inspection carried out to check the final component against the specification accompanied with a written record of any measurements and subsequent errors or issues. • Written commentary that evaluates the process and suggests improvements. 		

Task 4: Produce components using Additive Manufacturing techniques

(This task should take between 3 and 4 hours.)

Learning Outcome 4: 'Be able to produce components using additive manufacturing techniques' is assessed in this task.

Your task is to produce a report for the engineering manager to present back to the client explaining different additive manufacturing techniques. You should then assess how additive manufacturing can be used for the production of final components in advanced applications.

Produce a mounting block component using additive manufacturing techniques and export STL data from a 3D CAD model.

Pass	Merit	Distinction
P6: Explain different additive manufacturing techniques in 3D printing.		D3: Assess how additive manufacturing techniques are used for the production of final components and in advanced applications.
P7: Produce a 3D component using additive manufacturing techniques.	M4: Produce 3D CAD data for the component in STL file format.	
Evidence		
<p>You should show the process by which you have arrived at the production of the component using additive manufacturing techniques including the creation of STL data from a 3D Computer Aided Design (CAD) system.</p> <p>This could be presented as an electronic or paper-based report that illustrates the process you have undertaken including, imagery, photographs of the machine set-up and production process plus the finished component(s).</p> <p>A written report explaining the types of additive manufacturing techniques and assesses how these techniques can be used for the production of final components in advanced applications.</p>		

Evidence Checklist

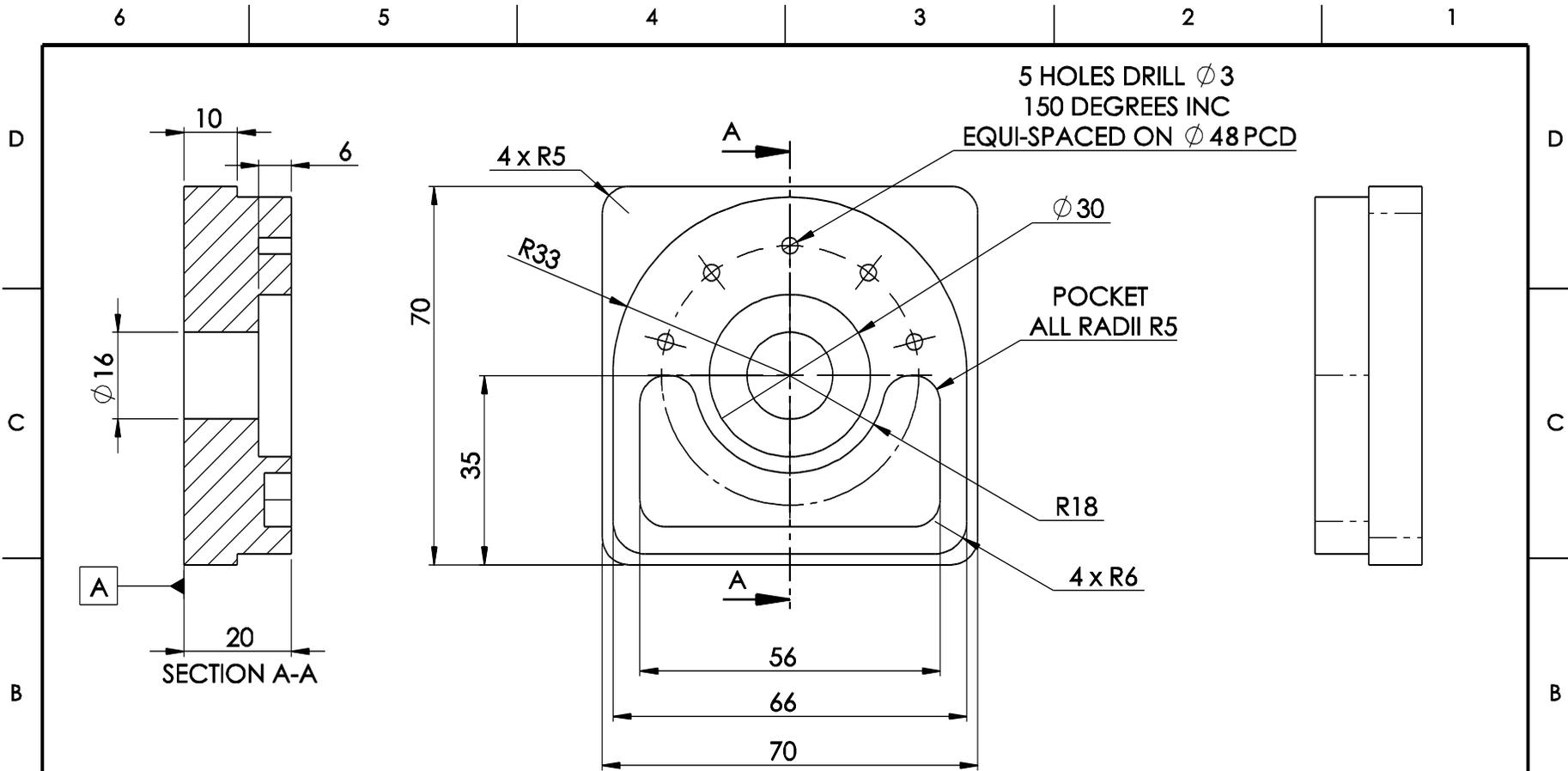
OCR Level 3 Cambridge Technicals in Engineering Unit 17: Computer Aided Manufacturing (CAM)

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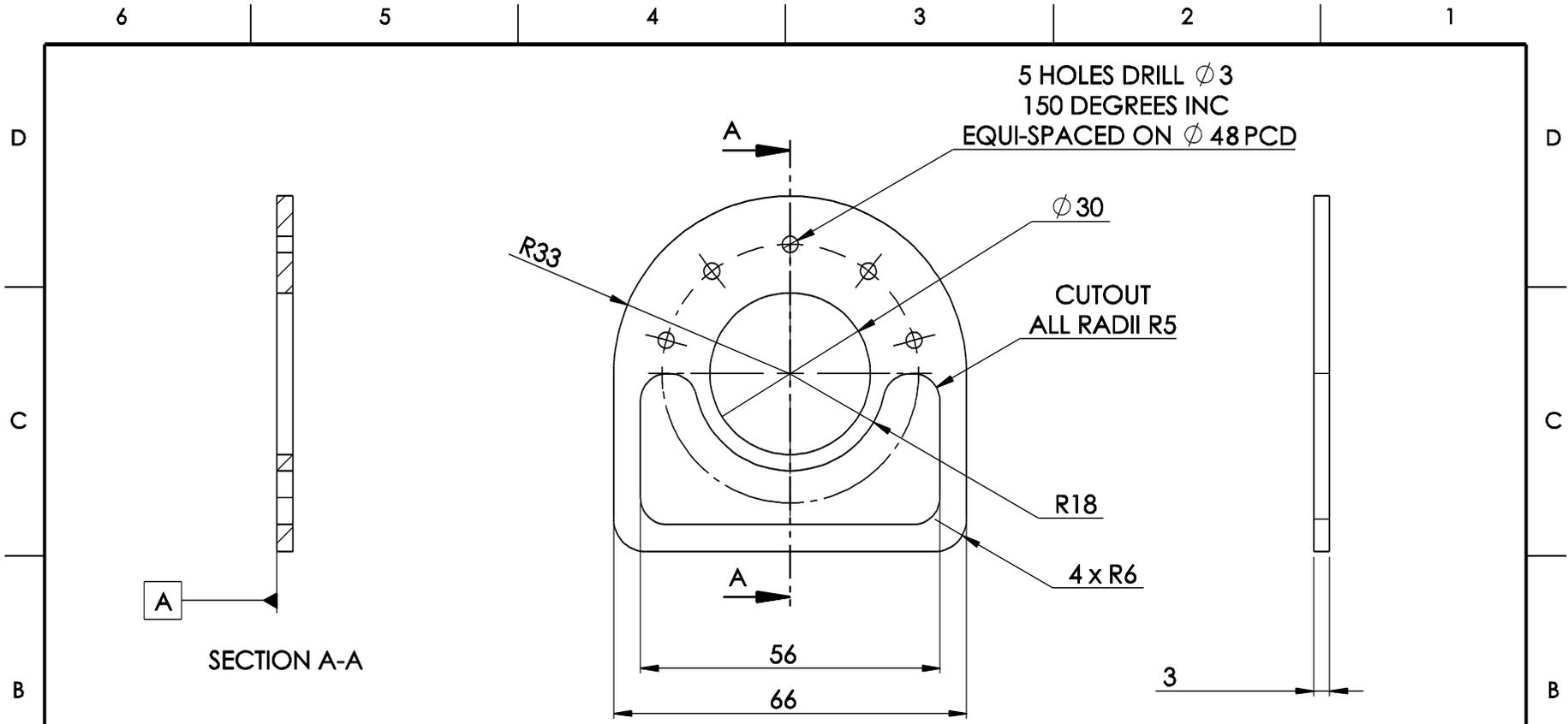
For Pass have you: (as a minimum you have to show you can meet every pass criterion to complete the unit)	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
Explained how computers are used in manufacturing systems (P1)	
Planned the production of a CNC machined component (P2)	
Produced a CNC part program utilising manual programming techniques (P3)	
Used mathematical calculation to assist in the production of accurate part programs for use within a CNC machine (P4)	
Set-up and operated a CNC machine to produce components (P5)	
Explained the different types of additive manufacturing techniques used in 3D printing (P6)	
Produced a 3D component using additive manufacturing techniques (P7)	

For Merit have you:	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
Analysed the advantages of using computers in manufacturing (M1)	
Produced a CNC part program using CAD/CAM software (M2)	
Proved the accuracy of a machining process by checking a final result against specification (M3)	
Produced 3D CAD data for a component in STL file format (M4)	

For Distinction have you:	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
Analysed the advantages of the use of CAD/CAM software rather than manual programming techniques for a CNC machined component (D1)	
Evaluated the effectiveness of the Computer Aided Manufacturing (CAM) process you have used and made recommendations for possible improvements (D2)	
Assessed how additive manufacturing techniques are used for the production of final components and in advanced applications (D3)	



OCR Oxford, Cambridge and RSA			UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ±0.1 ANGULAR: ±1		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION																									
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ocr.org.uk/engineering

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Alternatively, you can email us on **vocational.qualifications@ocr.org.uk**



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