



# basic education

---

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## MECHANICAL TECHNOLOGY (FITTING AND MACHINING)

### GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2023

These guidelines consist of 24 pages.

**TABLE OF CONTENT**

	<b>PAGE</b>
<b>1. INTRODUCTION</b>	<b>3</b>
<b>2. TEACHER GUIDELINES</b>	<b>4</b>
2.1 Administration of PAT	4
2.2 Assessment of PAT	4
2.3 Moderation of PAT	4
2.4 Consequences of absence/non-submission of tasks	4
2.5 Declaration of authenticity	5
<b>3. CANDIDATE GUIDELINES</b>	<b>6</b>
Instructions to the candidates	6
<b>4. SPECIALISATION</b>	<b>7</b>
Fitting and Machining	7
Rubrics and Tolerances	10
Phase 1	11
Phase 2	13
Phase 3	16
Phase 4	18
Bearing Puller Totals	23
<b>5. CONCLUSION</b>	<b>24</b>

## 1. INTRODUCTION

The 18 Curriculum and Assessment Policy Statement subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- **AGRICULTURE:** Agricultural Management Practices, Agricultural Technology
- **ARTS:** Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- **SCIENCES:** Computer Applications Technology, Information Technology, Technical Sciences, Technical Mathematics
- **SERVICES:** Consumer Studies, Hospitality Studies, Tourism
- **TECHNOLOGY:** **Mechanical Technology**, Civil Technology, Electrical Technology, and Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the end-of-year examination mark. The PAT is implemented across the first three terms of the school year. This is broken down into different phases or a series of smaller activities that make up the PAT. The PAT allows for candidate to be assessed on a regular basis during the school year and it also allows for the assessment of skills that cannot be assessed in a written format, e.g., test or examination. It is therefore important that schools ensure that all candidates complete the practical assessment tasks within the stipulated period to ensure that candidate are resulted at the end of the school year. The planning and execution of the PAT differs from subject to subject.

The PAT allows the teacher to directly and systematically observe applied competence. The PAT comprises the application/performance of the knowledge, skills and values particular to that subject and counts 25% of the total promotion/certification mark out of 400 for the subject.

The PAT is implemented across the first three terms of the school year.

Any profession requires of its members a thorough grounding in both theory and practice and MECHANICAL TECHNOLOGY is no exception. It is emphasized that the goal of the practical assessment task is to produce a skilled candidate in each specialisation field. A nation's true wealth is in its manpower and education that should aim to develop the talents of a candidate so that he/she can contribute to the well-being of the society by using and developing scientific and technological resources.

To prepare a candidate in MECHANICAL TECHNOLOGY specialisation fields, one must focus on the following:

- An attitude where the candidate can selectively use ideas, gather evidence and facts, to drawing logical conclusions to put them to good use creatively and with imagination;
- A capability to express ideas and information clearly by speech, writing, drawing and manufacturing and
- A willingness and capability to accept and exercise responsibility, to make decisions, and to learn by experience.

Attributes such as these cannot all be achieved in a classroom. A sound knowledge of engineering sciences is essential to equip the MECHANICAL TECHNOLOGY candidate with the necessary practical capabilities for the required processes. Practical training is the application of acquiring essential skills to bridge the gap between trade theory and practice.

Practical application in the workshop must therefore be made an interesting and challenging experience to develop the candidates both physically and mentally. The candidates must show his/her initiative, curiosity and persistence to learning. In order to stimulate and develop self-confidence the granting of some degree of responsibility during the practical application is very important.

## 2. TEACHER GUIDELINES

### 2.1 Administration of the PAT

Teachers are requested to make copies of the different specialisation PAT documents. These documents need to be handed out to the candidates at the beginning of the year. The Practical Assessment Task for Grade 12 is externally set, internally assessed and externally moderated.

Teachers must attach due dates for the different facets of the PAT (*refer to the CAPS document*). In this manner, candidates can easily assess their progress. Instances where formal assessments take place, it is the responsibility of the teacher to administer assessment.

The PAT should be completed within the first three terms. The PAT should be completed under controlled conditions (*refer to Mechanical Technology SPECIALISATION: CAPS Grade 10–12*).

**Teachers MUST build a prototype of the task to be able to demonstrate to the candidates what the final product will look like.** It will guide the candidates with visual presentation. It provides the teacher with insight into possible challenges regarding machines, equipment or material and what possible manufacturing procedures he/she need to follow in the workshop in order to complete the PAT.

### 2.2 Assessment of PAT

Frequent and developmental feedback is needed to ensure necessary guidance and support to the candidates.

Both formal and informal assessment should be conducted to ensure that the embedded skills are developed. Informal assessment can be conducted only to monitor progress of the candidates. Formal assessment should always be conducted and recorded.

On completion of each phase in each term, the marks for the completed phase need to be recorded onto the school administration system.

### 2.3 Moderation of PAT

The tasks, projects, assessment criteria as well as the mark sheets must be presented to the moderator during moderation of the PAT.

The moderator should be able to call on a candidate to explain and demonstrate the functions, principles and skills during the moderation process.

On completion, the moderator will, if necessary, adjust the marks of the group upwards or downwards depending on the decision reached as a result of moderation.

Task must be clearly marked with the correct initials and surname of each candidate.

### 2.4 Consequences of absence/non-submission of tasks.

If a candidate's practical assessment task is incomplete or unavailable with valid reason, the candidate may be given three weeks before the commencement of the final end-of-year examination to submit the outstanding task. Should the candidate fail to fulfil the outstanding PAT requirement, such a candidate will be awarded a zero mark for that PAT component.

A candidate's results are regarded as incomplete if he/she does not offer any component of the PAT task. He/she will be given another opportunity based on the decision of the head of the assessment body. Should the candidate fail to fulfil the outstanding PAT requirement, the marks for these components will be omitted and the final mark for Mechanical Technology will be adjusted for promotion purposes in terms of the completed tasks. If any tasks are still outstanding, the candidate runs the risk of not being resulted at the end of the year.

## 2.5 Declaration of Authenticity

NAME OF THE SCHOOL:

---

NAME OF CANDIDATE:

---

(FULL NAME(S) AND SURNAME)

NAME OF TEACHER:

---

I hereby declare that the project submitted for assessment is my own, original work and has not been previously submitted for moderation.

---

SIGNATURE OF CANDIDATE

---

DATE

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his or her own.

---

SIGNATURE OF TEACHER

---

DATE

SCHOOL STAMP

### 3. CANDIDATE GUIDELINES

#### Instructions to the candidates

- The practical assessment task (PAT) consists of a specialisation task in **Fitting and Machining**. The practical work is spread over three terms, as set out in this document (see *CAPS document*).
- All tasks must be completed according to the time frames set out in each of the tasks.
- Candidates are requested to actively engage in all practical assessment tasks.
- Candidates who are uncooperative will receive demerits or a zero mark for that particular section of the work.
- Candidates who act unsafely in the workshop and place other learners in danger, will be given additional corrective tasks to improve their safety awareness.
- Your task must be fully completed by end of August 2023 to be ready for provincial and/or national moderation.
- Your task needs to be **clearly marked** with your name and surname.
- Each term must have a completed phase in order to enter the mark on the working mark sheet and school administration and management system (**SA-SAMS**).

4. FITTING AND MACHINING (SPECIFIC)

TASK: TWO-LEG BEARING PULLER

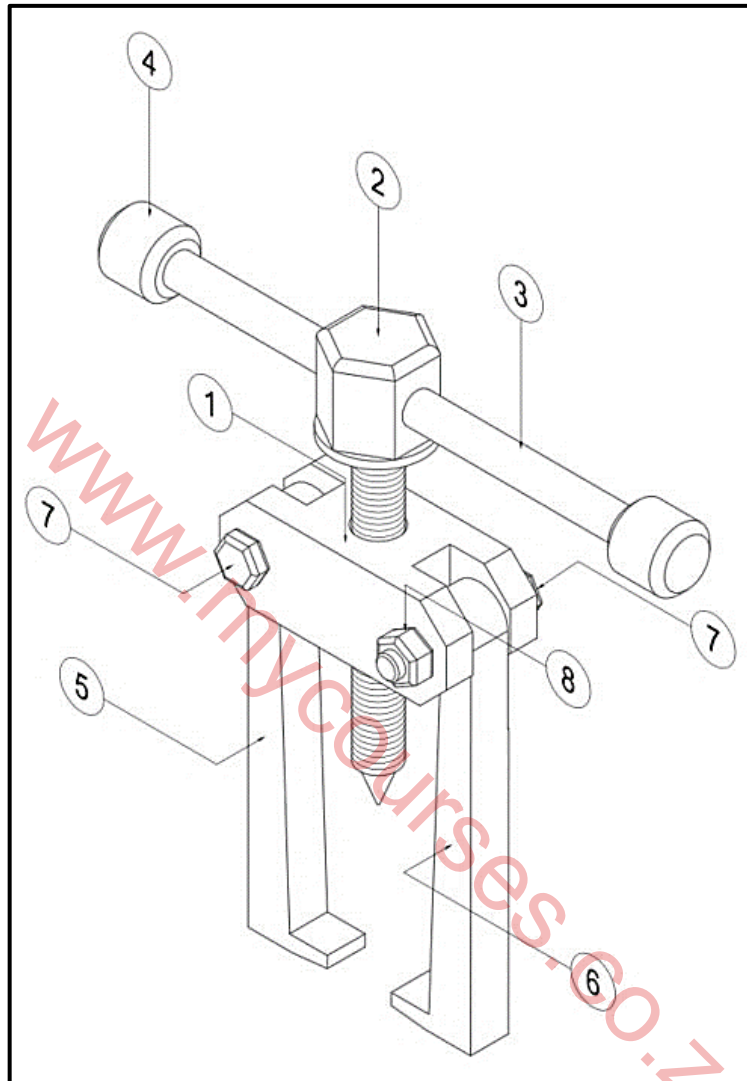


FIGURE 1: ISOMETRIC DRAWING

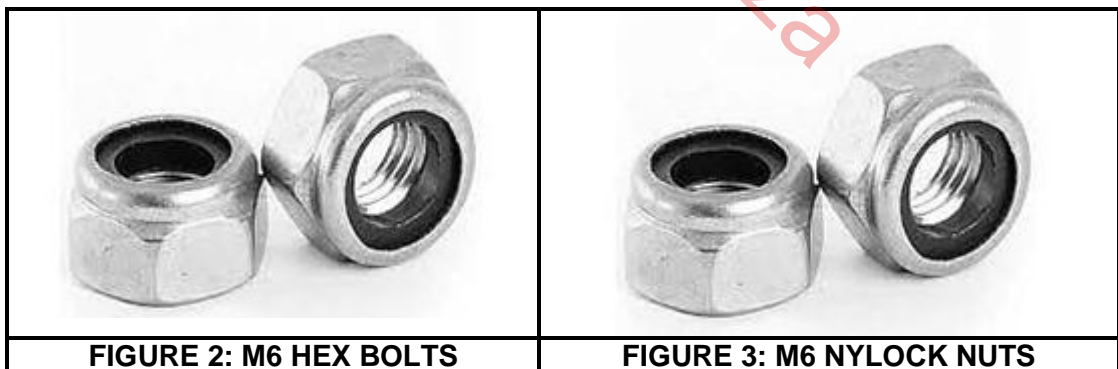
PART LIST			
	PART	QUANTITY	MATERIAL
1	Block	1	Mild steel/Aluminium
2	M12 x 1,75 screw	1	Mild steel/Aluminium
3	Handle bar	1	Mild steel/Aluminium
4	Handle bar knob	1	Mild steel/Aluminium
5	Left leg	1	Mild steel/Aluminium
6	Right leg	1	Mild steel/Aluminium
7	M6 hex bolt	2	Mild steel
8	M6 hex nylock nut	2	Mild steel and nylon

**Term: 1 to 3****Start date: January 2023****Completion date: August 2023****The following standards must be achieved:**

- All sizes must be within the given tolerance.
- There must be no damage to tools and equipment.
- All appropriate safety procedures must be adhered to.
- The project must be well presented.

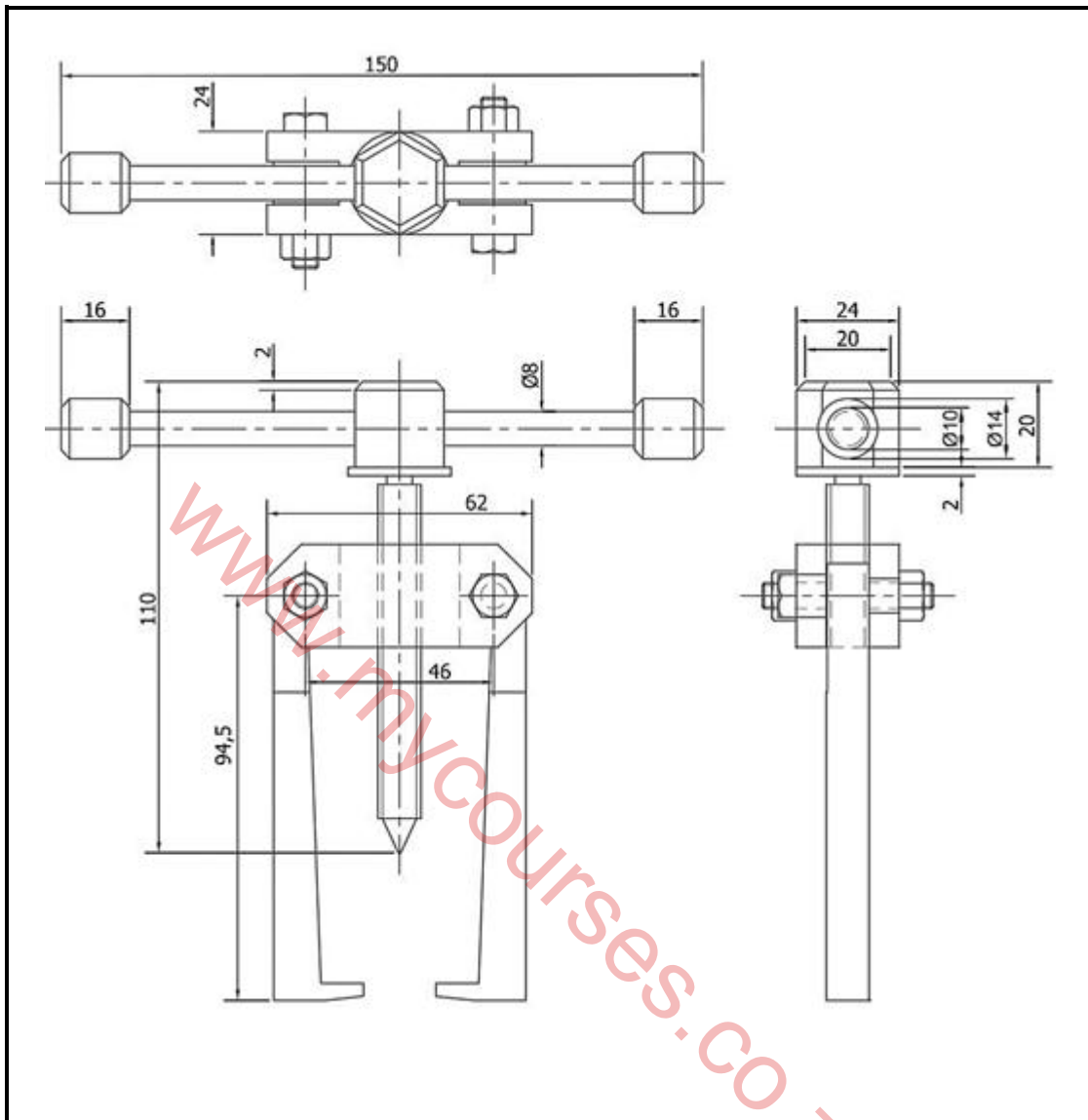
**RESOURCES REQUIRED FOR PAT:**

CONSUMABLE MATERIALS REQUIRED PER CANDIDATE					
Part	Material	Cutting list	Quantity per candidate	No. of candidates	Total quantity
Block	Mild steel/Aluminium 25 x 25 square bar	70 x 25 x 25	1		
M12 x 1,75 screw	Mild steel/Aluminium 25 mm round bar	120 x 25	1		
Handle bar	Mild steel/Aluminium 16 mm round bar	160 x 16	1		
Handler bar knob	Mild steel/Aluminium 16 mm round bar	50 x 16	1		
Left leg	Mild steel/Aluminium 25 x 10 mm flat bar	110 x 25 x 10	1		
Right leg	Mild steel/Aluminium 25 x 10 mm flat bar	110 x 25 x 10	1		
M6 hex Bolt	Mild steel	M6 x 1,00 x 30	2		
M6 hex nylock nut	Mild steel and nylock nut	M6 nylock nut	2		

**EXAMPLES:****FIGURE 2: M6 HEX BOLTS****FIGURE 3: M6 NYLOCK NUTS**



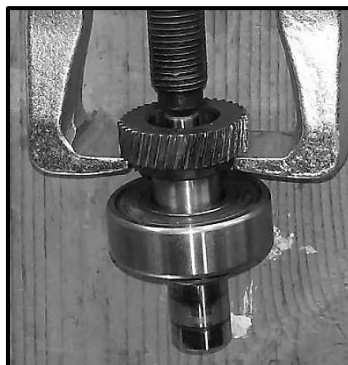
**COMPLETE VIEW AND GENERAL DIMENSIONS**



**FIGURE 4: BEARING PULLER**

**NOTE TO TEACHER: TEST FOR FUNCTIONALITY**

The teacher should manufacture a simple shaft with a press fit ring/bearing/pulley in order to test for the functionality of the completed bearing puller. It may be made from nylon. Alternative measures may also be used, e.g. a shaft with fitted bearing/-pulley/-gear.



**EXAMPLE 1**

**RUBRICS****DRILLING AND TAPPING**

**NOTE:** Use RUBRIC A below for assessment of all holes to be drilled.

<b>RUBRIC A – DRILLING</b>	
<b>Assessment facet</b>	<b>Mark</b>
Hole drilled in correct position on work piece	1
Drilling of correct diameter of hole	1
Depth correctly drilled (blind or open hole)	1
Hole perpendicular to work piece	1
Hole clean and without burrs	1
<b>Subtotal:</b>	<b>5</b>

**NOTE:** Use RUBRIC B below for assessment of all internal and external screw threads to be tapped.

<b>RUBRIC B – TAPPING OF SCREW THREADS</b>	
<b>Assessment facet</b>	<b>Mark</b>
Cut correct screw thread	1
Screw thread perpendicular to work piece	1
Screw thread is smooth	1
Depth/Length tapped correctly	1
No defects (e.g. cross thread)	1
<b>Subtotal:</b>	<b>5</b>

**TOLERANCE RANGES****LENGTH AND DIAMETERS**

**NOTE:** On all the lengths and diameters candidates will lose 1 mark for every 0,1 mm deviation from the basic size. Use RUBRIC C for assessment of all lengths and diameters.

<b>RUBRIC C -LENGTHS AND DIAMETERS</b>	
<b>Deviation</b>	<b>Mark deductions</b>
0–0,1	-0
0,1–0,2	-1
0,2–0,3	-2
0,3–0,4	-3
0,4–0,5	-4
0,5 and more	-5

**PHASE 1: BLOCK**  
January–March 2023

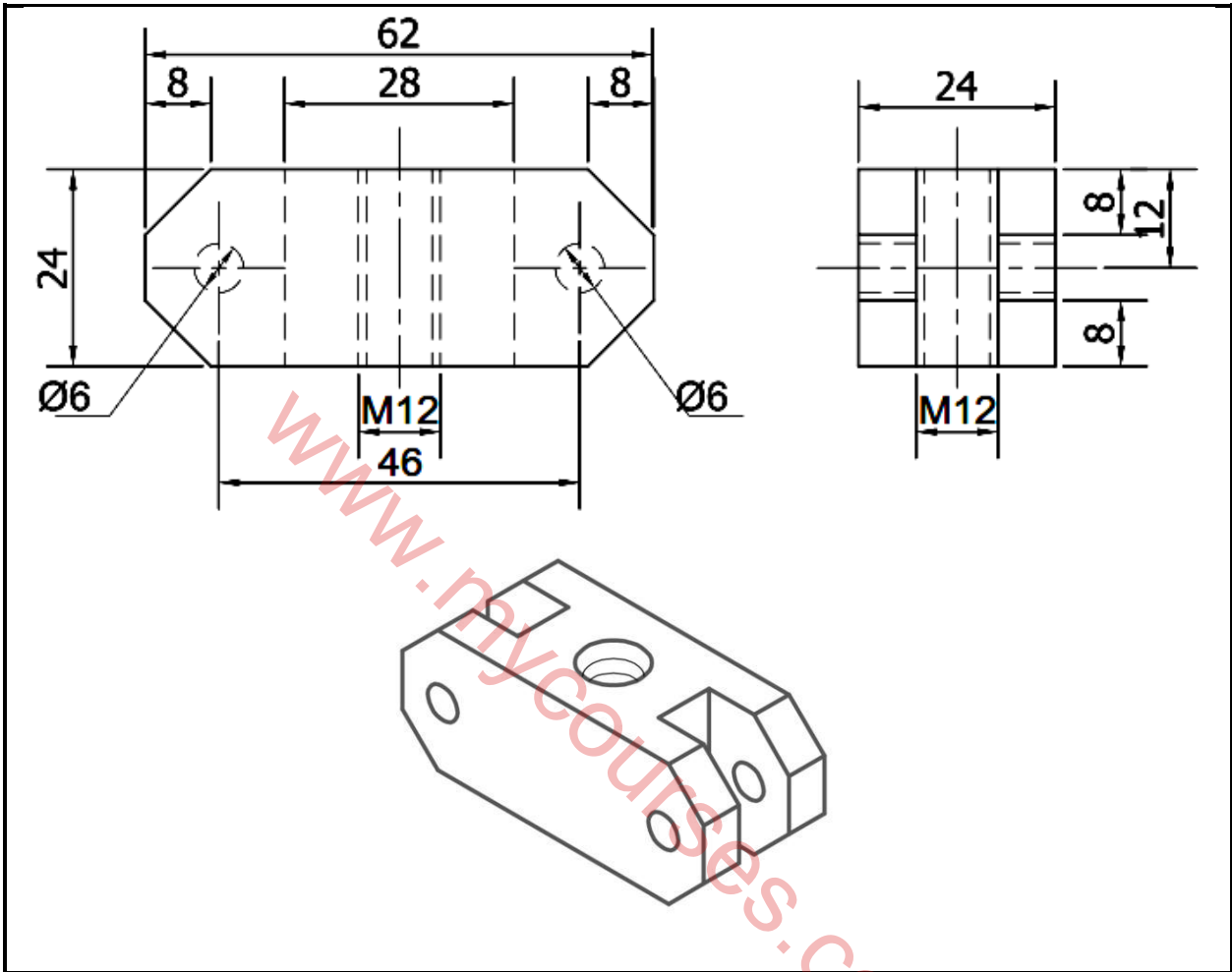
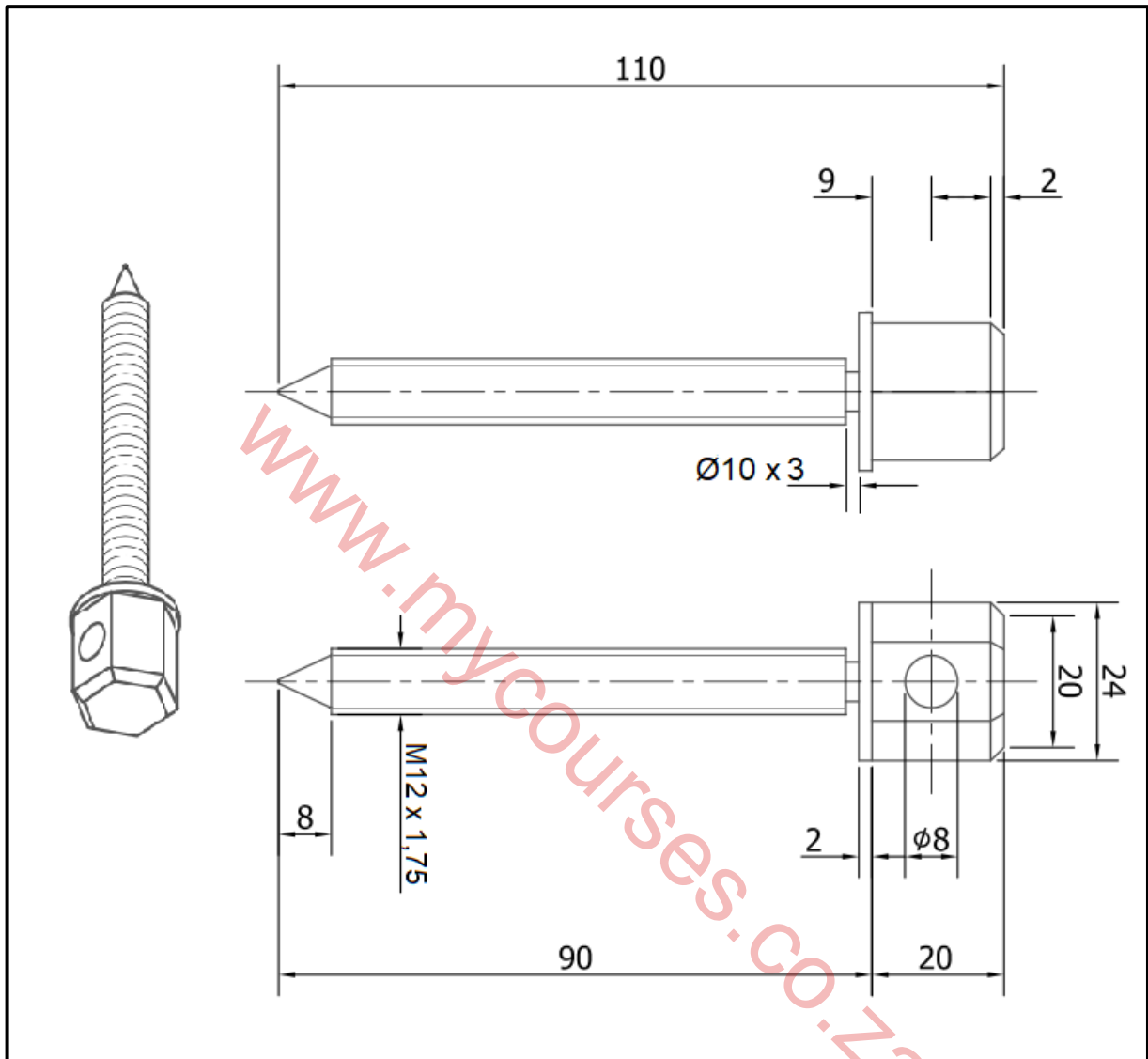


FIGURE 5: BLOCK

MECHANICAL TECHNOLOGY											
FITTING AND MACHINING											
MARK SHEET – BLOCK – PHASE 1											
GRADE	12	DATE									
PROJECT	BEARING PULLER										
FACETS	MARKS	CANDIDATES									
		1	2	3	4	5	6	7	8	9	10
Cutting/Machining 62 mm length	5										
Cutting/Machining 24 x 24 mm thickness	5										
Marking of 45° angles (4 x 2)	8										
Drill Ø6 mm holes (2 x 5)	10										
Drill Ø10,2 mm hole	5										
Tap Ø10,2 mm hole to M12	5										
Cutting/Machining of 45° angles (4 x 5)	20										
Cutting/Machining leg slots (2 x 5)	10										
Finishing	2										
<b>Subtotal:</b>	<b>70</b>										
<b>PHASE1 TOTAL:</b>	<b>50</b>										
<b>NAME AND SIGNATURE OF TEACHER</b>											
<b>NAME AND SIGNATURE OF DEPARTEMENTAL HEAD</b>											
<b>NAME AND SIGNATURE OF SUBJECT MODERATOR</b>											

**PHASE 2: SCREW**  
April–June 2023



**FIGURE 6: SCREW**

MECHANICAL TECHNOLOGY													
FITTING AND MACHINING													
MARK SHEET – SCREW – PHASE 2													
GRADE	12	DATE											
PROJECT	BEARING PULLER												
FACETS	MARKS	CANDIDATES											
		1	2	3	4	5	6	7	8	9	10		
LENGTH	Screw total length to 110 mm	5											
	Screw thread total length – 77 mm	5											
	Groove behind shoulder – 3 mm	5											
	Centre point – 8 mm	5											
	Hexagon length to 20 mm	5											
	Shoulder length – 2 mm	5											
	Chamfer length – 2 mm	5											
CUT SCREW THREAD	Calculate cutting depth of screw thread (Worksheet 1.1)	3											
	Screw thread depth cut correctly	5											
	Screw thread cut cleanly (No tears)	2											
HEXAGON	Calculate cutting depth on hexagon (Worksheet 1.2)	6											
	Cut to correct depth	5											
	Machine all sides equal to size.	5											
	Chamfering on hexagon	2											
DRILLING	Drilling of Ø8 mm hole	5											
	Finishing	2											
	<b>Subtotal:</b>	<b>70</b>											
	<b>PHASE 2 TOTAL:</b>	<b>50</b>											
<b>NAME AND SIGNATURE OF TEACHER</b>													
<b>NAME AND SIGNATURE OF DEPARTEMENTAL HEAD</b>													
<b>NAME AND SIGNATURE OF SUBJECT MODERATOR</b>													

**WORKSHEET 1: SCREW THREAD CALCULATIONS.**

**CANDIDATE NAME:**

1.1 Calculate the cutting depth of the screw thread

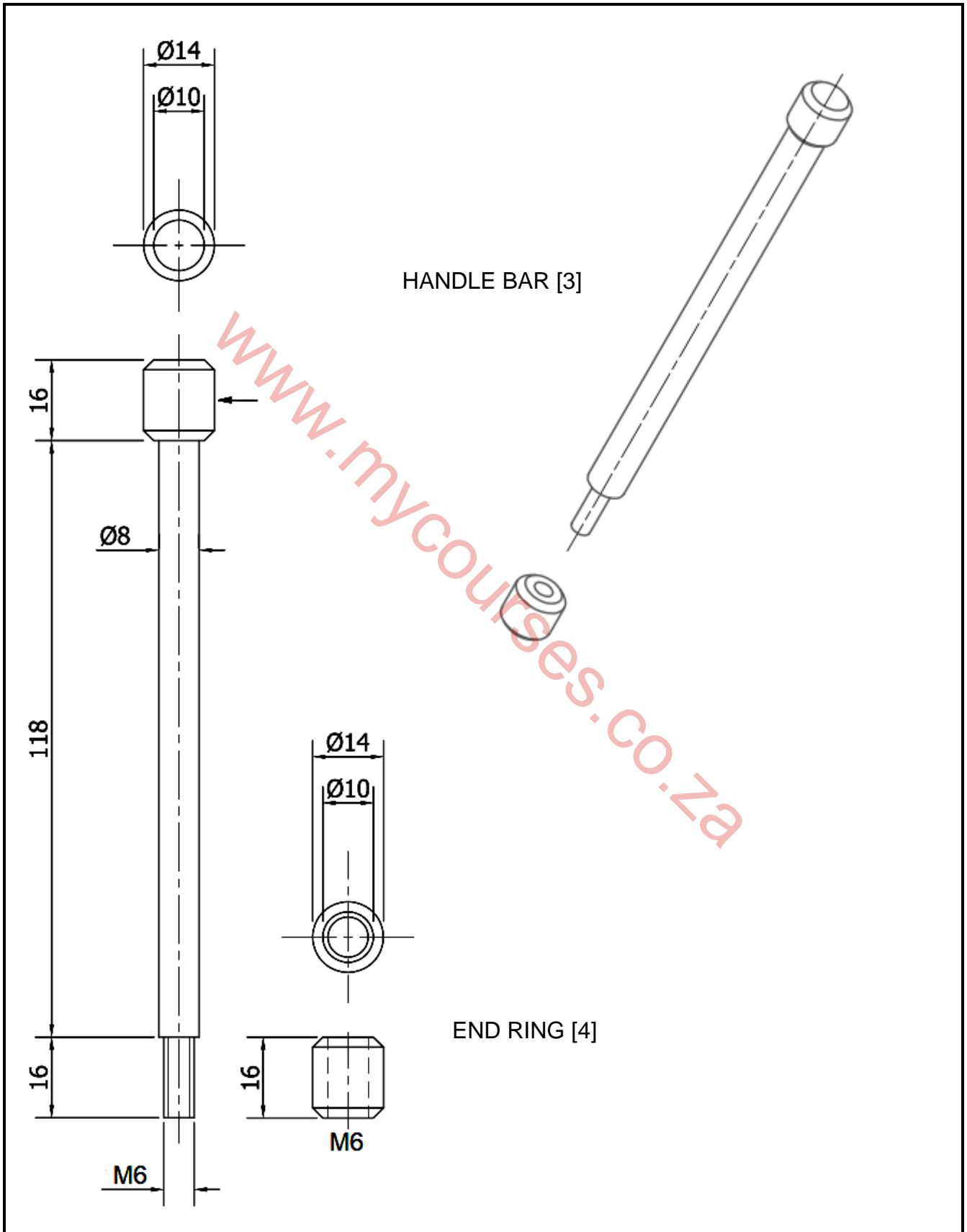
(3)

1.2 Calculate the cutting depth of the hexagon

(6)

**NOTE:** This worksheet MUST be evident in the candidate's portfolio of evidence.

**PHASE 3: HANDLE BAR**  
July–August 2023

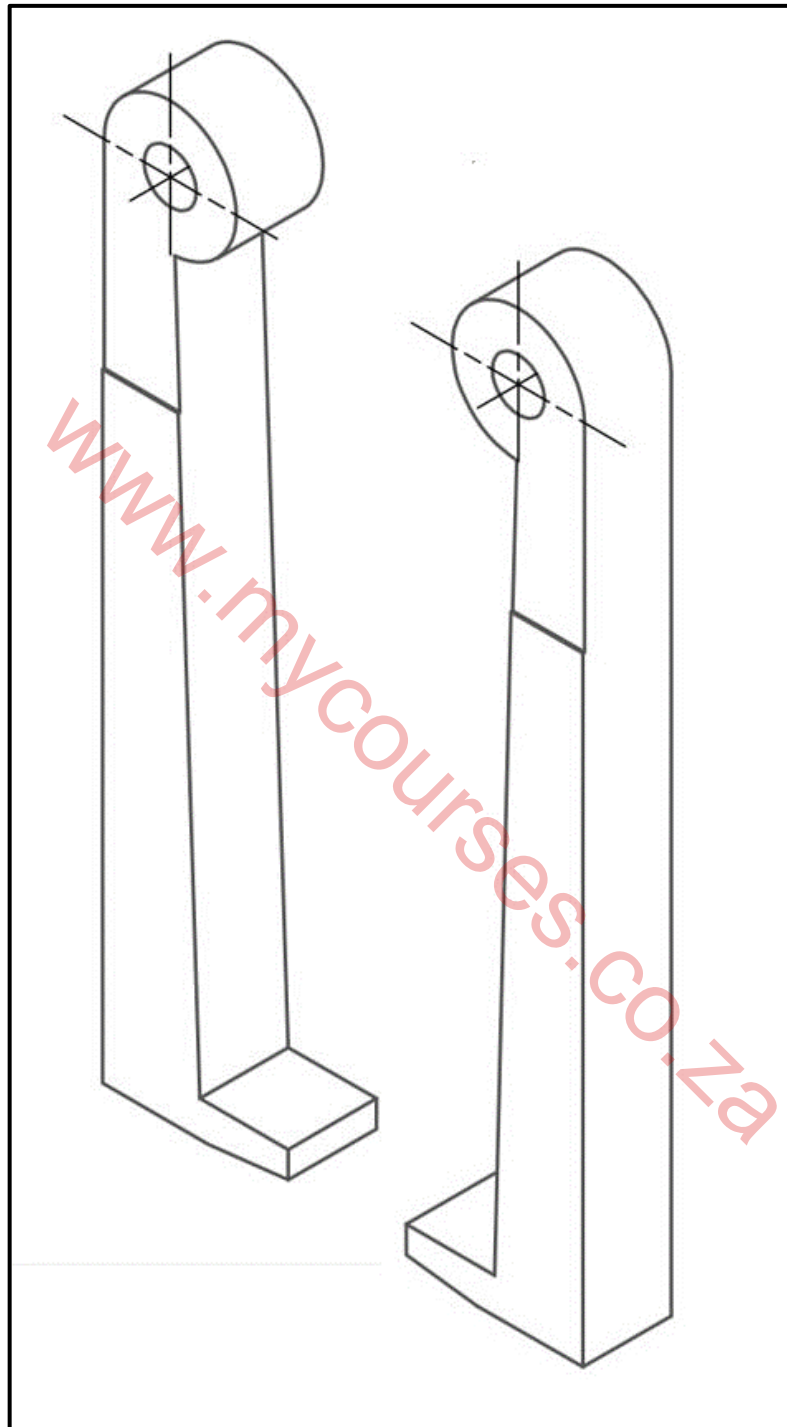


**FIGURE 7: HANDLE BAR**



MECHANICAL TECHNOLOGY												
FITTING AND MACHINING												
MARK SHEET – HANDLE BAR – PHASE 3												
GRADE	12	DATE										
PROJECT	BEARING PULLER											
FACETS			CANDIDATES									
			MARKS									
			1	2	3	4	5	6	7	8	9	10
Handle bar and fixed knob	Total length of 150 mm	5										
	Ø6 mm length of 16 mm	5										
	Ø8 mm length of 118 mm	5										
	Ø14 mm length of 16 mm	5										
	Chamfer both sides of fixed knob 2 mm (2 x 2)	4										
	Ø6 mm to size	5										
	M6 external screw thread	5										
	Ø8 mm to size	5										
	Ø14 mm to size	5										
End ring	Ø14mm to size	5										
	Drill 5 mm hole to tap M6	2										
	M6 internal screw thread	5										
	Ø14 mm length of 16 mm	5										
	Chamfer both sides 2 mm (2 x 2)	4										
	Fit end ring straight and neat	3										
Finishing		2										
Subtotal:		70										
PHASE 3 TOTAL:		50										
NAME AND SIGNATURE OF TEACHER												
NAME AND SIGNATURE OF DEPARTEMENTAL HEAD												
NAME AND SIGNATURE OF SUBJECT MODERATOR												

**PHASE 4: BEARING PULLER LEGS**  
January–August 2023



**FIGURE 8: BEARING PULLER LEGS**

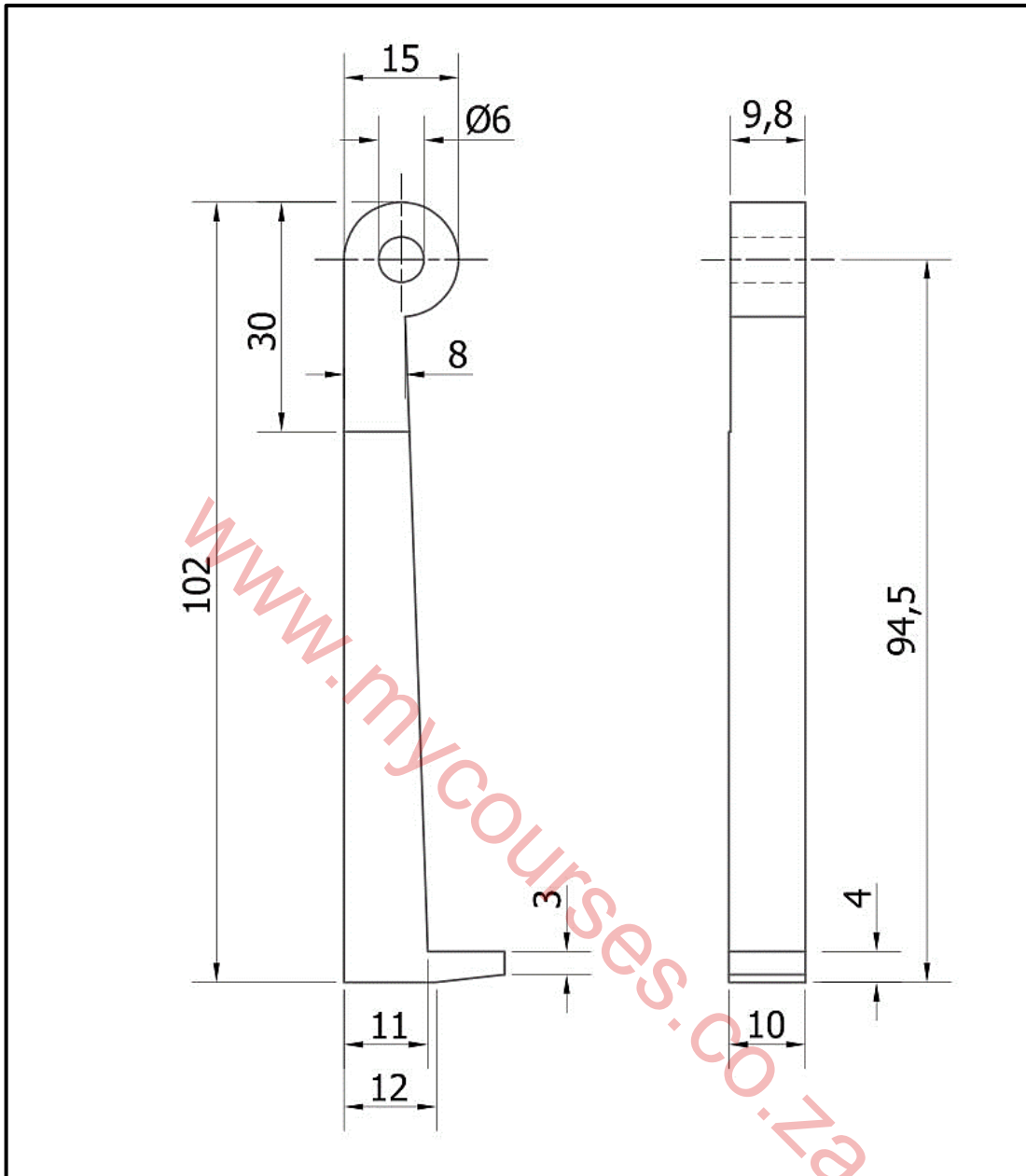


FIGURE 9: BEARING PULLER LEG – LEFT

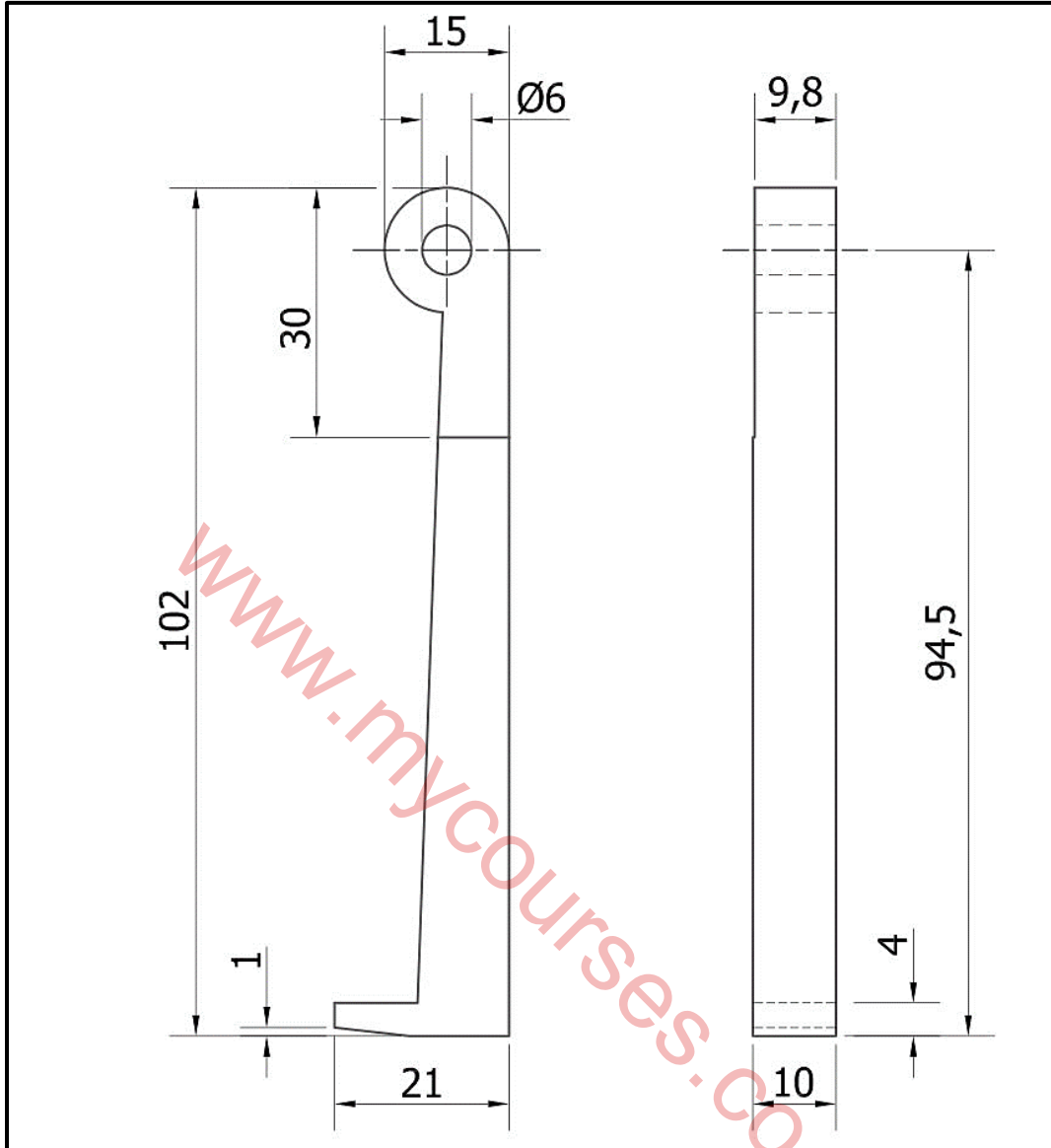


FIGURE 10: BEARING PULLER LEG – RIGHT



MECHANICAL TECHNOLOGY												
FITTING AND MACHINING												
MARK SHEET- BEARING PULLER LEGS AND ASSEMBLY- PHASE 4												
GRADE	12	DATE										
PROJECT	BEARING PULLER											
FACETS – RIGHT LEG			CANDIDATES									
			MARKS									
		1		2	3	4	5	6	7	8	9	10
RIGHT LEG	Marking out of blank metal piece	10										
	Drill Ø6 mm hole	5										
	Reduce from 10 mm to 9,8 mm thickness	5										
	Reducing of leg 30 mm in length	5										
	Machining of taper side	5										
	Small end of taper – 8 mm	5										
	Big end of taper – 11 mm	5										
	Machine/File jaw of leg – 21 mm	5										
	Reduce taper of jaw from 4 mm to 3 mm towards the end	5										
	Jaw flat length – 12 mm	5										
	Machine/File round section according to given dimensions.	5										
	Total length of leg – 102 mm	5										
	Finishing (Machine/Drill/File)	5										
	<b>Subtotal for Right Leg:</b>		<b>70</b>									
<b>Subtotal for Left Leg:</b>		<b>70</b>										
<b>LEFT LEG + RIGHT LEG:</b>		<b>140</b>										
<b>(Average of both legs) = Subtotal:</b>		<b>70</b>										
Legs same size and shape		10										
Assembly		10										
Functionality test		10										
<b>PHASE 4 TOTAL:</b>		<b>100</b>										
<b>NAME AND SIGNATURE OF TEACHER</b>												
<b>NAME AND SIGNATURE OF DEPARTEMENTAL HEAD</b>												
<b>NAME AND SIGNATURE OF SUBJECT MODERATOR</b>												

MECHANICAL TECHNOLOGY											
FITTING AND MACHINING											
MARK SHEET – TOTALS											
GRADE		12		DATE							
PROJECT		BEARING PULLER TOTALS									
		CANDIDATES									
FACETS	MARKS										
		1	2	3	4	5	6	7	8	9	10
PHASE 1	50										
PHASE 2	50										
PHASE 3	50										
PHASE 4	100										
<b>TOTAL:</b>	<b>250</b>										
<b>Total PAT Mark:</b>	<b>100</b>										
<b>NAME AND SIGNATURE OF TEACHER</b>											
<b>NAME AND SIGNATURE OF DEPARTEMENTAL HEAD</b>											
<b>NAME AND SIGNATURE OF PRINCIPAL</b>											
<b>NAME AND SIGNATURE OF SUBJECT MODERATOR</b>											

## 5. CONCLUSION

On completion of the practical assessment task candidates should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real-world challenges. The PAT furthermore develops the candidate's life skills and provides opportunities for candidates to engage in their own learning.

[www.mycourses.co.za](http://www.mycourses.co.za)