education
Department: Education
GAUTENG PROVINCE

MECHANICAL TECHNOLOGY

FITTING and MACHINING

GRADE 11

PRACTICAL ASSESSMENT TASKS

2025

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SECTION A: EDUCATOR GUIDELINES FOR PAT GRADE 11

1. Background

The 17 National Curriculum Statement subjects which contain a practical component all include a Practical Assessment Task (PAT), i.e., a Practical or Performance Assessment Task. These subjects are:

AGRICULTURE:	Agricultural Management Sciences, Agricultural Technology
ARTS:	Dance Studies, Design, Dramatic Arts, Music, Visual Arts
HSS:	Life Orientation
SCIENCES:	Computer Applications Technology, Information Technology
SERVICES:	Consumer Studies, Hospitality Studies, Tourism
TECHNOLOGY:	Civil Technology, Electrical Technology, Engineering Graphics and Design, **MECHANICAL TECHNOLOGY**

A PAT allows the Educator 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% (i.e. 100 marks) of the total promotion/ certification mark out of 400 for the subject. In the two Arts subjects Design and Visual Arts, the PAT counts 37.5% (i.e. 150 marks) 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** and should be undertaken as *one extended task*, which is *broken down into different phases* or a series of *smaller activities* that make up the promotion PAT mark. The planning and execution of the PAT *differs from subject to subject*.

Section A are guidelines to Educators, **Section B** should be given to Learners at the beginning of the year.

Any profession requires of its members a thorough grounding in both practice and theory, and **MECHANICAL TECHNOLOGY** is no exception. It is emphasized that the goal of the Practical Assessment Task is not to produce a skilled craftsperson but a Mechanical Technology Learner in the broadest sense. A nation's true wealth is in its human potential / resource and education should aim to develop the talents of Learners so that they can contribute to the well-being of society by using scientific and technological resources with the greatest efficiency and by continuing to develop them.

To prepare a Learner in **MECHANICAL TECHNOLOGY** for one or more of these activities his/ her education should develop in him/ her:

A *mentality* which can selectively assimilate ideas, evidence and facts, and by drawing logical conclusions put them to good use creatively and with imagination;
A *capability* to express ideas and information clearly by speech, writing, sketching or formal drawing by hand or computer package;
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 applicable *technical science and maths* is essential to the **MECHANICAL TECHNOLOGY** Learner, so also is the close practical acquaintance with the processes. There is no substitute for acquiring the “feel” of things on the shop floor, where training in the art of making things, the essential bridge between theory and practice, can be so readily obtained.

Practical application in the workshop must therefore be made an *interesting and challenging* experience, mentally and physically, with encouragement to the Learner to use their *initiative, curiosity and persistence* in finding things out for themselves. *Learning by watching* should be kept to the *bare minimum*. Enabling the Learner with some degree of responsibility during practical application is very important as a stimulus and to *develop self-confidence*.

PAT tasks must not be confused with the *practical application* of the subject during workshop practice sessions that is assessed informally. These artefacts are to be kept as proof of progress – Learner’s names / form of identification must be clearly attached to these artefacts.

2. The structure of the PAT for Mechanical Technology

The Practical Assessment Task is designed and developed for a Learner to use and demonstrate the various skills they acquired during workshop practice to manufacture a project of a high quality. The PAT is made up of an integration (or a combination) of various topics as is found in the CAPS document. Safety and tools will always form an integral part of the PAT’s.

Take Note: The Technological Process per se, which was covered in detail, in the GET Phase, does not form part of the Practical Assessment Task in the FET Phase – Yet the concepts and methods form the foundation in the planning and execution of all tasks and processes. The focus and emphasis now, will be on a Learner's ability to read and follow instructions in order to produce accurate quality projects. Each Learner must complete the four phases of the PAT under controlled conditions and under the supervision of the teacher. No group work is allowed.

The Practical Assessment Task consists of **FOUR** phases that the Learner must complete as set out in the table on the next page. Phase four will be a combination of skills that have been shown in phases one to three.

STRUCTURE OF THE PAT

PROCESS OF THE PAT		TOPIC	MARKS
TERM 1	Phase 1 Task	Terminology / Outside Taper Turning	**50**
	Phase 4 Task	*Teacher to Prepare (material and equipment)*	
TERM 2	Phase 2 Task	Terminology / Inside Taper Turning	**50**
	Phase 4 Task	*Under construction*	
TERM 3	Phase 3 Task	Terminology / Manufacturing	**50**
	Phase 4 Task	Terminology / Lathe machines */ Complete Task*	**100**
		TOTAL MARKS	**250 Convert to 100**

Educators must attend to the following in their preparation:

The planning process;
The knowledge and skills to be achieved;
The safety and environmental aspects to be considered;
The applicable calculations, sketches and/ or diagrams;
The starting time and ending time – how long it took to complete from start to finish;
Bill of materials;
List of tools needed; and
Any other information that is relevant to the project.

3. Administration of the PAT

The PAT (all phases) should be **completed in the first three terms**. The PAT must be completed under controlled conditions.

Educators must attach their own due dates for the different phases of the PAT (Refer: Mechanical Technology CAPS Gr10 – 12 Document.

In this manner, Learners can easily assess their progress. Instances where formal assessments take place, it is the responsibility of the Educator to administer the assessment.

Educators are requested to make copies of **Section B** and distribute to Learners at the beginning of the year. Learners should receive the assessment criteria of the PAT at the beginning of the year when the PAT is handed out and this must be mediated with the Learners.

4. Assessment and moderation of the Practical Assessment Task

To ensure national standardization the PAT's for Grade 12 are externally set and moderated, but internally assessed. The PAT's for Grade 10 and 11 have to follow a similar standardization process but this is done provincially and thus are set by allocated people and moderated by the Subject Advisers for Mechanical Technology.

4.1 Assessment

Frequent developmental feedback by the Educator is needed to guide and give support to the Learner to ensure that the Learner is progressing as envisaged.

Both *formal and informal assessment* should be conducted on the different phases that constitute the PAT. Informal assessment can be conducted by the Learners themselves, by a peer group of Learners, or by the Educator. Formal assessment should always be conducted by the Educator and must be recorded on the working mark sheets distributed by the Subject Advisers, these also constitute the final mark sheet for the subject and must always be available in printed format in the Educators File. These mark sheets must be updated and printed after each formal assessment. Note that the School and District structures may require results to be transferred to other documents/ systems like SASAMS, in this instance ALL results must correspond on all systems. Any differences must be brought to the attention of the Subject Advisor so that the error can be rectified.

4.2 Moderation

During moderation of the PAT, the project/ skills tasks will be presented to the moderator with the assessment criteria and marks obtained on the **facets mark sheet** and the **combined Excel working** mark sheet.

Where required, the moderator should be able to call on the Learner to explain the function, principles of operation and also request the Learner to exhibit the skills acquired through the capability tasks for moderation purposes.

4.3 Time planning:

Phase 1: Complete at the end of first term – **March.**

Phase 2: Complete at the end of second term – **June.**

Phase 3: Complete during third term - End of **September.**

Phase 4: Plan and start task during the first term and complete at the end of **September.**

SECTION B: THE PRACTICAL ASSESSMENT TASK GRADE 11

FITTING AND MACHINING

The Practical Assessment Task (PAT) consists of FOUR Phases, one per term over term 1 to 3, with the **Phase 4 Task** to be started in the **First Term** and **completed in the Third Term** – Thus spanning all three terms. Term 4 is reserved for the final theoretical content and revision.

NO Practical Assessment Tasks are planned or to be completed in in *TERM 4*! PAT will only be allowed to be completed in exceptional situations.

MARKING RUBRICS FOR FITTING AND TURNING

DRILLING AND TAPPING

NOTE:
Use the Rubric A below for assessment for all holes to be drilled.

RUBRIC A - DRILLING OF HOLES	
Assessment facet	**Mark**
Drilling of correct diameter of hole	1
Depth correctly drilled	1
Hole clean and without burrs	1
Hole perpendicular to workpiece	1
Hole drilled to correct position on workpiece	1
Sub-total:	**5**

NOTE:
Use the Rubric B below for assessment for all internal and external screw threads to be tapped.

RUBRIC B – TAPPING OF SCREW THREADS	
Assessment facet	**Mark**
Cut correct screw thread	1
Screw thread perpendicular to workpiece	1
Screw thread has no burs on outside	1
Depth/length to be tapped correctly	1
No defects (e.g., Cross thread)	1
Sub-total:	**5**

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 on all lengths and diameters.

RUBRIC C - LENGTHS AND DIAMETERS	
DEVIATION	**MARK DEDUCTIONS**
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

Safety (5)

- Less 1 mark: Repetitive disregard for the use of PPE while working in the workshop.
- Less 1 mark: Another negative mark for continuing to have a disregard for the use of PPE while working in the workshop.
- Less 1 mark: Quality versus Time – “rush” job vs inefficient time to complete a good job
- Less 1 mark: Not cleaning machine after work session.
- Less 5 marks: Dangerous and fooling around in workshop, machines and equipment.

Finishing (5)

- Less 1 mark for vice (jaw) damage - clamping marks for overtightening or loose slip.
- Less 1 mark for lack of overall manufacturing competency in finishing / “look” of completed task related to surface finish and edges.
- Less 1 mark for lack of overall manufacturing competency in square-ness of project.
- Less 1 mark for lack of overall manufacturing competency in centrality, etc.

ABSENCE / NON-SUBMISSION OF TASKS

If a learner's practical assessment task is incomplete or unavailable for a valid reason, the learner will be given three weeks before the commencement of the final end-of-year examinations to submit the outstanding task. Should a learner fail to fulfil the outstanding PAT requirement such a learner will be awarded a zero (0) for that PAT component.

A learner'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 learner 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.

PHASE ONE:

Terminology - Turning Task – External Taper

Procedure:

The following task is to let the learners get to know how to work with the lathe machine.

Choice of material to be used is Aluminium or Nylon / Teflon.

READ ALL THE INSTRUCTIONS FIRST - THEN PROCEED

FOLLOW ASSESSMENT INSTRUCTIONS - AS INDICATED

Resources Required:

- Aluminium or steel Ø50mm rough cut at 150mm long.
- Centre lathe with related attachments and tools.
- Lathe cutting tools for facing, parallel turning, taper cutting and parting off.
- Vernier and other measuring equipment (callipers, steel rule etc).
- Marking medium (Engineers blue, Koki pen, chalk etc.)
- Marking off instruments (Square, scriber etc.)
- Appropriate Personal Protection Equipment (PPE).

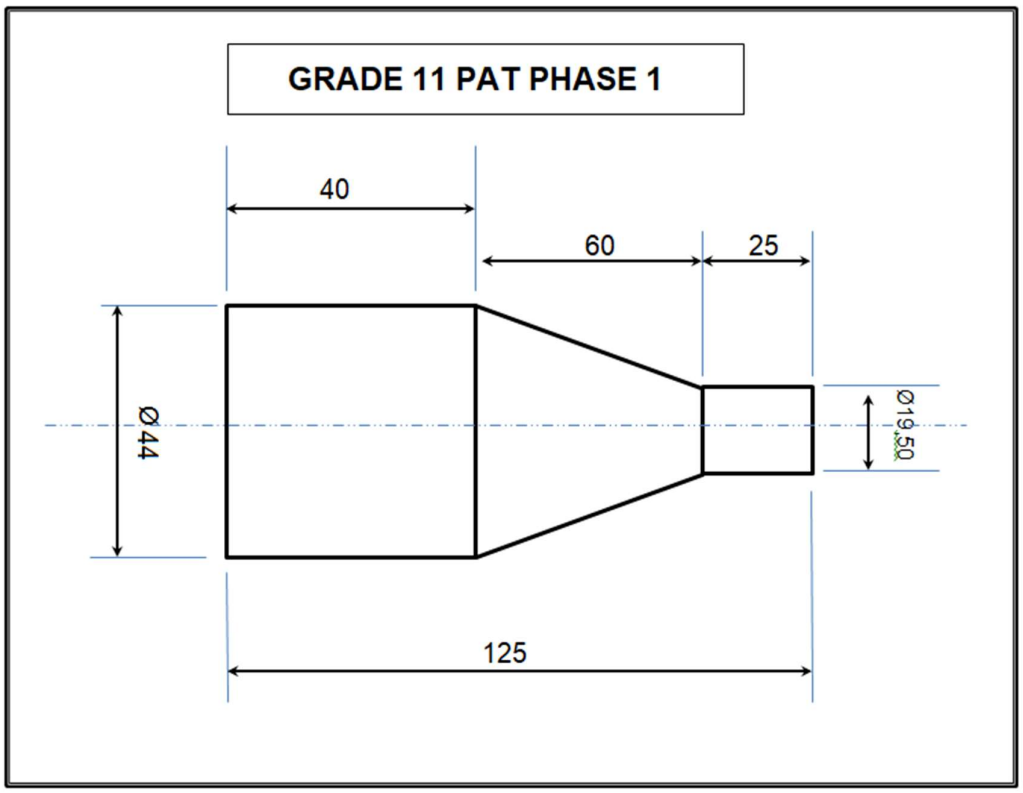
Activity Outcome

• Learners familiarize themselves with the use of tools and machines.
• Learners apply theoretical and practical knowledge in which they obtained during Grade 10 practical.

Requirements:/Tools:

- Lathe machine
- . Tool bit holder and key
- Tool facing and cutting parallel surfaces
- Chuck and Tailstock centre
- Two tool bits
- Vernier calliper

Fitting and Machining – Phase 1 PAT Task



Method

1. Material needed: 150 – 200 mm aluminium bar (steel may also be used)
2. Face both ends and centre drill each end
3. Reduce diameter to 44 mm
4. From one end – reduce diameter for a length of 25 mm to 19,50 mm
5. Calculate the degrees that the compound slide must be set to in order to cut the taper of a length of 60 mm where the big diameter is 44 mm and the small diameter is 19,50 mm. (If the measurements are out, the learner must use his own measurement to calculate the taper in order for the taper to be still correct)
6. From the end of the taper, measure a length of 40 mm and part the project. The total length must come then to a measurement of 125 mm.

This worksheet MUST be evident in the learner's portfolio file and be presented for moderation

WORKSHEET 1.1			
TRUE MEASUREMENTS. Learner measure final diameter BEFORE attempt of calculations and setting of compound slide angle.			
1.1.1 True Measurement	Ø	5	
1.1.2 Calculations			
$\tan\frac{\theta}{2}=\frac{D-d}{2\times l}$ $(l = \text{Taper length})$			
		5	

Marking Rubric – PAT Task 1 - Phase 1 – External Taper

GRADE: 11	**YEAR: 2025**	**SCHOOL:**	
DATE STARTED:		**DATE COMPLETED:**	
FITTING AND MACHINING		**EDUCATOR:**	
PROJECT: PAT TASK 1		**NUMBER OF LEARNERS:**	

Page 1 of …

Turning Task

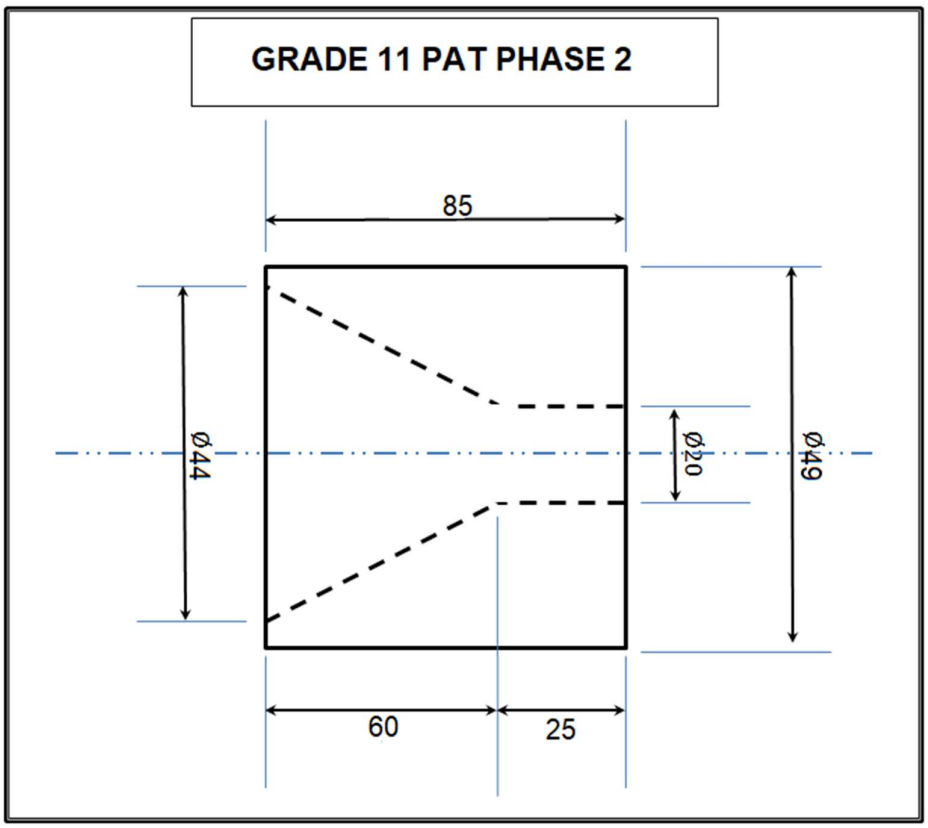
		FACETS												
			Diameter			Taper		Length						
TASK: PHASE 1 **External Taper**		Facing / centre drill x 2	Ø 44 mm	Ø 19,50 mm	True measurements of diameter	Taper Calculations – Worksheet 1.1	Cutting of taper	25mm Length (Ø 19,50)	60mm Length (Taper)	40mm Length (Ø 44)	Safety	Finishing	**Sub-Total**	**TOTAL**
Learner Names		**10**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**60**	**50**
1	Learner – Self-Assessment													
	Date of self-assessment:													
2	Teacher Assessment													
	Comment:													
3	Internal Moderation													
	Comment:													
4	Provincial Moderation													
	Comment:													
5	External Moderation													
	Comment:													

General Feedback:

SIGNATURE OF EDUCATOR:		Date:
SIGNATURE OF HEAD OF DEPARTMENT:		Date:
SIGNATURE OF PRINCIPAL:		Date:
SIGNATURE OF SUBJECT ADVISOR:		Date:

PHASE TWO:

Terminology - Turning Task – Internal Taper



Method:

1. Material needed: 100 – 150 mm aluminium bar (steel may also be used)
2. Face both ends and centre drill each end
3. Reduce diameter to 49 mm
4. Drill a 15mm centre hole in the work piece and then bore to a size of 20 mm (It must be deep enough when parting is done, the end is open)
5. Calculate to what degree the compound slide must be set to in order to cut the internal taper.
6. Use the appropriate boring bar to cut the taper.
7. The taper must be at the big end 44 mm in diameter and a length of 60 mm.
8. When the cutting procedure is completed, the PAT Task from Term 1 must be able to fit neatly in this internal taper.

This worksheet MUST be evident in the learner's portfolio file and be presented for moderation

WORKSHEET 2.1			
TRUE MEASUREMENTS. Learner measure final diameter BEFORE attempt of calculations and setting of compound slide angle.			
2.1.1 True Measurement	Ø	5	
2.1.2 Calculations			
$\tan\frac{\theta}{2}=\frac{D-d}{2\times l}$ $(l = \text{Taper length})$			
		5	

Marking Rubric – PAT Task Phase 2 -Term 2 – Internal Taper

GRADE: 11	**YEAR: 2025**	**SCHOOL:**	
DATE STARTED:		**DATE COMPLETED:**	
FITTING AND MACHINING		**EDUCATOR:**	
PROJECT: PAT TASK 2		**NUMBER OF LEARNERS:**	

Page 1 of …

Turning Task

		FACETS												
			Diameter			Taper		Length						
TASK: PHASE 2 **Internal Taper**		Facing / centre drill x 2	Ø 49 mm	Ø 20 mm Hole bored	True measurements of diameter	Taper Calculations – Worksheet 2.1	Cutting of taper	85mm Length	60mm Length (Taper)	25mm Length (Ø 20 Hole)	Safety	Finishing	Sub-Total	**TOTAL**
Learner Names		**10**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**60**	**50**
1	Learner – Self-Assessment													
	Date of self-assessment:													
2	Teacher Assessment													
	Comment:													
3	Internal Moderation													
	Comment:													
4	Provincial Moderation													
	Comment:													
5	External Moderation													
	Comment:													

General Feedback:

SIGNATURE OF EDUCATOR:		Date:
SIGNATURE OF HEAD OF DEPARTMENT:		Date:
SIGNATURE OF PRINCIPAL:		Date:
SIGNATURE OF SUBJECT ADVISOR:		Date:

PHASE THREE:

TERMINOLOGY – SOFT-FACE HAMMER

NOTE: Phase 3 and Phase 4 will make out a complete project – a soft-face hammer. Phase 3 consist of the hammer head with two press fit components (nylon / brass) and Phase 4 the hammer handle.

Phase 3: Time frame

- Commencement date: July 2025
- Completion date: September 2025

HAMMER

FIGURE 3.1 – Example

PHASE 3 – HAMMER HEAD

FIGURE 3.2 – Example

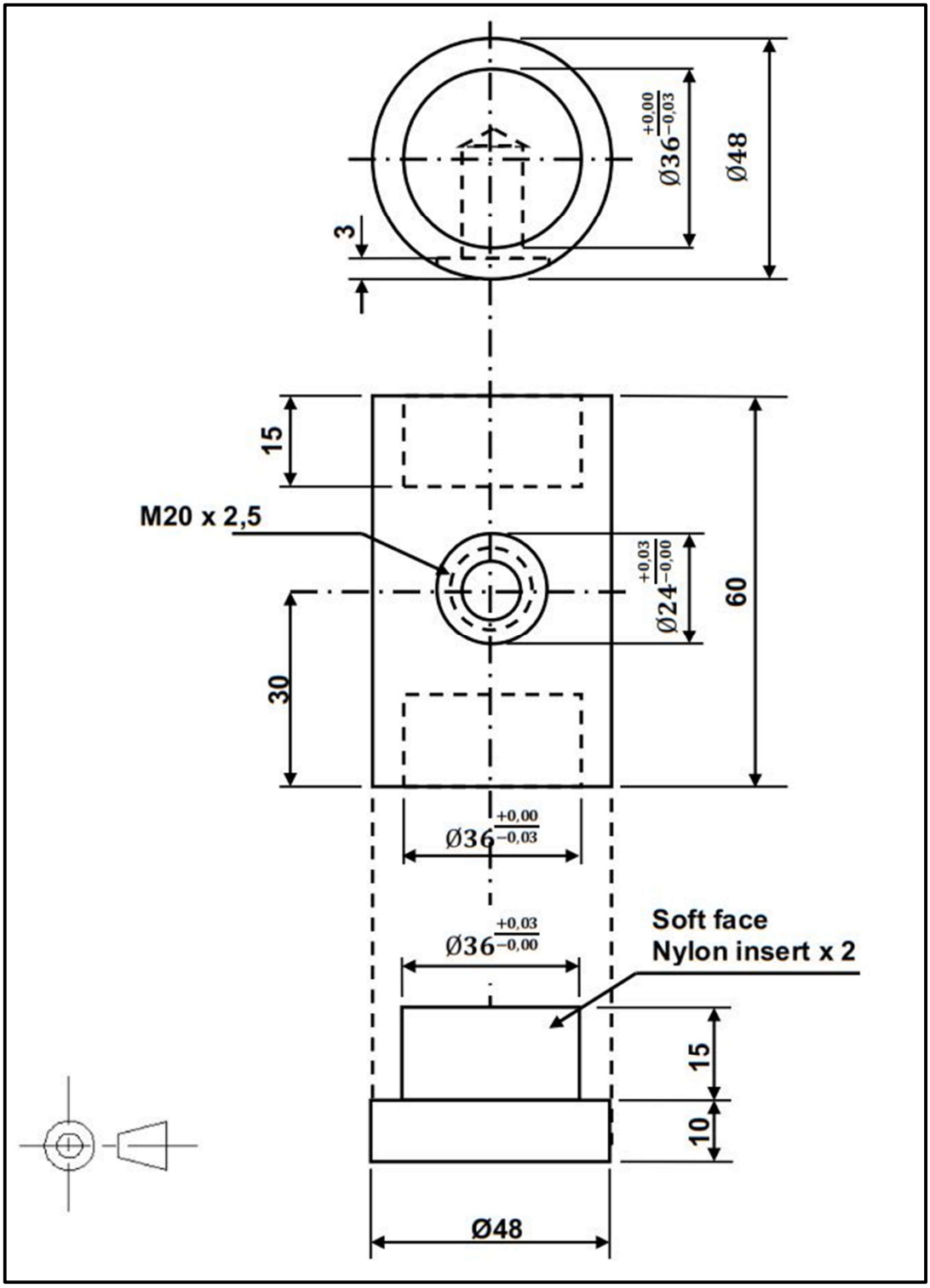
FIGURE 3.3 – Example

Phase 3: Specifications

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1.	Soft-hammer head	Any of the following: • Aluminium • Mild steel	Ø50 x 65 mm	1
2.	Hammer head insert	Any of the following: • Nylon • Brass	Ø50 x 30 mm	2

Phase 3: Processes

- Face both ends of the hammer head
- Drill and bore for nylon / brass inserts
- Drill and tap for handle
- Mill flat surface on head (Name or initials of learner)
- Face both ends of the nylon / brass insert
- Turn nylon / brass insert to required size (press fit into head)


Ø48
3
15
M20 x 2,5
60
30
Soft face
Nylon insert x 2
15
10
Ø48

Marking Rubric – PAT Phase 3 – Hammer Head

GRADE: 11	YEAR: 2025	SCHOOL:
DATE STARTED:		DATE COMPLETED:
MECHANICAL TECHNOLOGY – Fitting & Machining		EDUCATOR:
PROJECT: PAT PHASE 3		NUMBER OF LEARNERS:

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HAMMER HEAD

TASK: HAMMER HEAD		FACETS																
		Length						Diameter										
		Total Length – 80 mm	Insert 1 & 2 Big diameter – 10 mm	Insert 1 & 2 Small diameter – 15 mm	Body Length – 60 mm	Boring depth side 1 & 2 – 15 mm	Milling flat surface – 3 mm deep	Press fit part 1 & 2 – Ø 48 mm	Press fit part 1 & 2 – Ø 36 mm	Body – Ø 48 mm	Boring side 1 & 2 – Ø 36 mm	Drilling of hole	Tapping to M20	Press fit 2 inserts	Safety	Finishing	Sub-total	TOTAL
NAMES OF LEARNERS		5	10	10	5	10	5	10	10	5	5	5	5	10	5	5	105	50
1	Learner – Self-Assessment																	
	Date of self-assessment:																	
2	Teacher Assessment																	
	Comment:																	
3	Internal Moderation																	
	Comment:																	
4	Provincial Moderation																	
	Comment:																	
5	External Moderation																	
	Comment:																	

General Feedback:

SIGNATURE OF EDUCATOR:	
SIGNATURE OF HEAD OF DEPARTMENT:	
SIGNATURE OF PRINCIPAL:	
SIGNATURE OF SUBJECT ADVISOR:	

PHASE FOUR – FINAL PHASE

PHASE 4 – SOFT-FACE HAMMER HANDLE

Phase 4: Time frame

Commencement date: January 2025

Completion date: September 2025

FIGURE 4.1 – Example

Phase 4: Specification

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1	Soft-face hammer handle	Any of the following: • Aluminium • Mild steel	Ø 30 x 260 mm	1

Phase 4: Processes

- Face both ends of the shaft
- Centre drill both ends
- Turn to required diameters
- Conduct necessary calculations
- Cut screw thread on lathe machine
- Knurl, taper turn and finish according to drawing

SOFT-FACE HAMMER HANDLE:

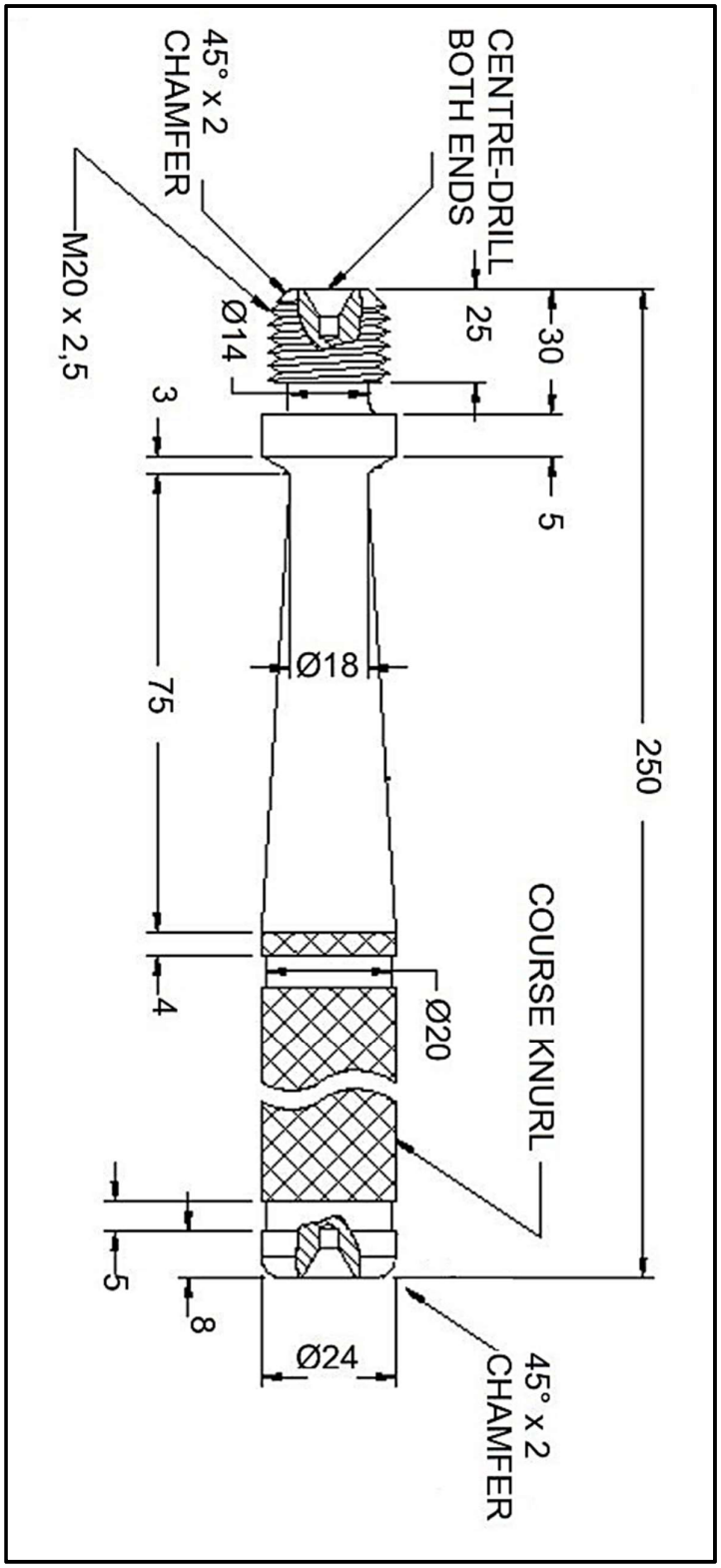

FIGURE 4.2

These worksheets MUST be evident in the learner's portfolio file and be presented for moderation

WORKSHEET 4.1			
TRUE MEASUREMENTS. Learner measure final diameter BEFORE attempt of calculations and setting of compound slide angle.			
4.1.1 True Measurement	Ø	5	
4.1.2 Calculations			
$\tan\frac{\theta}{2}=\frac{D-d}{2\times l}$ $(l = \text{Taper length})$			
		5	

WORKSHEET 4.2		
SCREW THREAD & INDEXING CALCULATIONS Learner measure final diameter BEFORE attempt of calculations and setting up of lathe machine for cutting screw thread. Screw thread MUST be cut on the lathe machine. Formulas: Height of screw thread = 0,866 × Pitch (P) Depth of screw thread = 0,613 × Pitch (P)		
4.2.1 Measurement of diameter before cutting of screw thread: (1)		
Ø = …… mm		
4.2.1 Height of screw thread: (2)		
4.2.2 Depth of screw thread: (2)		
	5	

Phase 4: Assessment: MARKING RUBRIC – PHASE 4

GRADE: 11	YEAR: 2025	SCHOOL:
DATE STARTED:		DATE COMPLETED:
MECHANICAL TECHNOLOGY – Fitting & Machining		EDUCATOR:
PROJECT: PAT PHASE 4		NUMBER OF LEARNERS:

Page 1 of …

HAMMER HANDLE

TASK: HAMMER HANDLE	FACETS																							
		DIAMETER					LENGHT																	
	Facing and centre drill	Taper – Ø18	Taper – Ø24	Handle – Ø24	Handle Grooves x 2 – Ø20	Screw thread back clearance groove– Ø14	Total – 250 mm	Grooves x 3 – 5 mm	Shoulder – 5 mm	Taper – 75 mm	Knurling behind taper – 4 mm	Between grooves – 115 mm	Back of handle – 8 mm	Chamfer x 2 – 2 mm	Cutting of screw thread on lathe	Screw thread distance	Worksheet 4.1	Worksheet 4.2	Knurling quality	Safety	Finishing	Assembly and functionality	**Sub-Total**	**TOTAL**
NAMES OF LEARNERS	**5**	**5**	**5**	**5**	**10**	**5**	**5**	**15**	**5**	**5**	**5**	**5**	**5**	**10**	**5**	**5**	**10**	**5**	**5**	**5**	**5**	**5**	**135**	**100**
1 Learner – Self-Assessment																								
Date of self-assessment:																								
2 Teacher Assessment																								
Comment:																								
3 Internal Moderation																								
Comment:																								
4 Provincial Moderation																								
Comment:																								
5 External Moderation																								
Comment:																								

SIGNATURE OF EDUCATOR:	
SIGNATURE OF HEAD OF DEPARTMENT:	
SIGNATURE OF PRINCIPAL:	
SIGNATURE OF SUBJECT ADVISOR:	

GRADE 11

PRACTICAL ASSESSMENT TASKS

PHASES ONE, TWO, THREE and FOUR

ANNEXURE B

DECLARATION OF AUTHENTICITY

NAME OF THE SCHOOL: ……

NAME OF LEARNER: ……..

(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER: ……..

NAME OF TEACHER: ……

SCHOOL STAMP

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

_____ _____

SIGNATURE OF LEARNER **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**

