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Department:  
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REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**ENGINEERING GRAPHICS AND DESIGN P2**

**FEBRUARY/MARCH 2011**

**MARKS: 100**

**TIME: 3 hours**

This question paper consists of 6 pages.

## INSTRUCTIONS AND INFORMATION

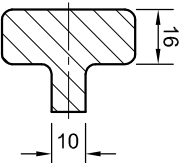
1. This question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings are in third-angle orthographic projection, unless stated otherwise.
4. ALL drawings must be drawn to scale 1:1, unless stated otherwise.
5. ALL the questions must be answered on the QUESTION PAPER as instructed.
6. ALL the pages must be restapled in numerical sequence, irrespective of whether the question was attempted.
7. Time management is essential in order to complete all the questions.
8. Print your examination number in the block provided on every page.
9. Any details or dimensions not given, must be assumed in good proportion.
10. ALL answers must be drawn accurately and neatly.

| FOR OFFICIAL USE ONLY |                |   |   |   |      |           |   |   |   |
|-----------------------|----------------|---|---|---|------|-----------|---|---|---|
| QUESTION              | MARKS OBTAINED |   |   | ½ | SIGN | MODERATED |   |   | ½ |
| 1                     |                |   |   |   |      |           |   |   |   |
| 2                     |                |   |   |   |      |           |   |   |   |
| 3                     |                |   |   |   |      |           |   |   |   |
| 4                     |                |   |   |   |      |           |   |   |   |
| TOTAL                 |                |   |   |   |      |           |   |   |   |
|                       | 2              | 0 | 0 |   |      | 2         | 0 | 0 |   |

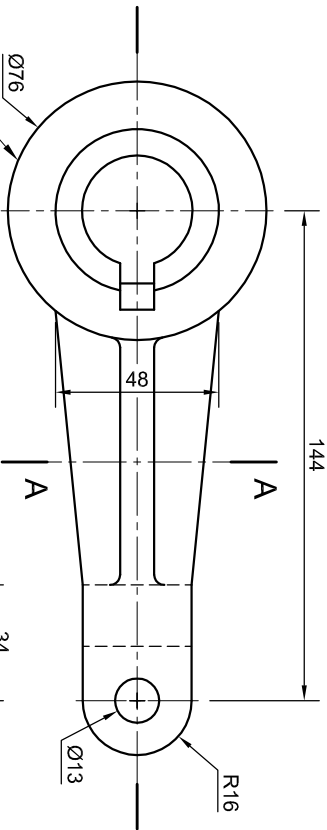
| FINAL CONVERTED MARK | CHECKED BY |
|----------------------|------------|
| 100                  |            |

| COMPLETE THE FOLLOWING: |  |
|-------------------------|--|
| CENTRE NUMBER           |  |
| CENTRE NUMBER           |  |
| EXAMINATION NUMBER      |  |
| EXAMINATION NUMBER      |  |

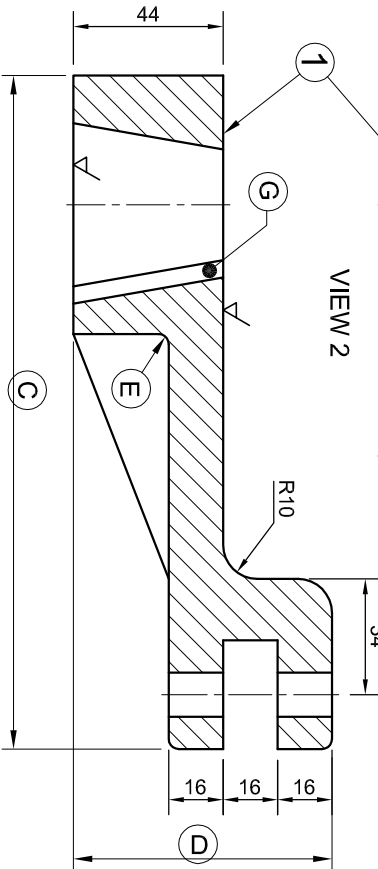




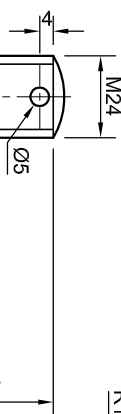
## SECTION A-A



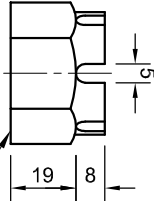
VIEW 2



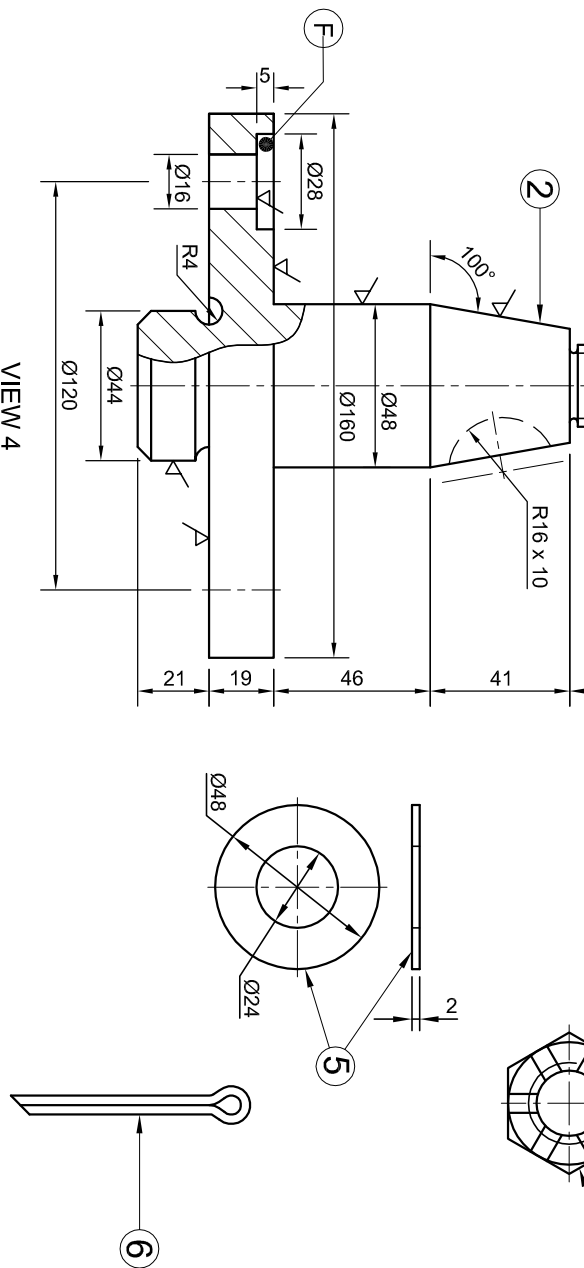
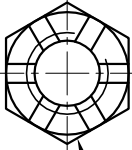
VIEW 3



၁



4



VIEW 4

|   |                    |   |                      |                                   |    |
|---|--------------------|---|----------------------|-----------------------------------|----|
| ALL DIMENSIONS ARE IN MILLIMETRES.                              |                    | 13/12/2010                                  | STEVEN               | INSERT KEY AND KEYWAY             | A  |
| UNLESS OTHERWISE SPECIFIED TOLERANCES ON DIMENSIONS ARE ± 0.15. | DRAWN BY: JOHAN    | DATE  | CHANGED BY           | REVISION DESCRIPTION              | No |
|   | DATE: 05/11/2010   | DRAWING NO. 2                               | FILE NAME: CRANK_003 | MATERIAL: MILD AND HARDENED STEEL |    |
| ALL UNSPECIFIED RADII ARE R3.                                   | CHECKED BY: DE WET | HEAT TREATMENT: NORMALISE                   |                      |                                   |    |
|   | DATE: 10/11/2010   |   |                      |                                   |    |
| DRAWING PROGRAM: AUTOCAD 2008                                   | APPROVED BY: ALIDA | MAXSTEEL                                    |                      |                                   |    |
|   | DATE: 20/11/2010   | GOVAN IBEKI DRIVE<br>PORT ELIZABETH<br>6001 |                      |                                   |    |
| SCALE: 1 : 2  |                    | MANUFACTURING<br><br>www.maxsteel.co.za     |                      |                                   |    |
| CRANK HANDLE  |                    |   |                      |                                   |    |

| PARTS LIST      |          |                |
|-----------------|----------|----------------|
| PART            | QUANTITY | MATERIAL       |
| 1. HANDLE       | 1        | MILD STEEL     |
| 2. SPINDLE      | 1        | MILD STEEL     |
| 3. WOODRUFF KEY | 1        | HARDENED STEEL |
| 4. CASTLE NUT   | 1        | HARDENED STEEL |
| 5. WASHER       | 1        | MILD STEEL     |
| 6. SPLIT PIN    | 1        | SPRING STEEL   |

**QUESTION 1: ANALYTICAL (MECHANICAL)**

**Given:**

Six parts of a crank handle with a title block and a table of questions.

**Instructions:**

Complete the table below by neatly answering the questions, which all refer to the accompanying drawings and the title block. [25]

**[25]**

# QUESTIONS

# ANSWERS

|    |  |          |          |   |
|----|--|----------|----------|---|
| 1  | On what date was the drawing drawn?  |          |          | 1 |
| 2  | What is the file name of the drawing?  |          |          | 1 |
| 3  | In which street is the manufacturing company situated?   |          |          | 1 |
| 4  | Who made changes to the drawing?   |          |          | 1 |
| 5  | What scale is indicated for the drawing?   |          |          | 1 |
| 6  | What is the tolerance allowed on the dimensions?   |          |          | 1 |
| 7  | What type of section is indicated with view 1?   |          |          | 1 |
| 8  | What would VIEW 3 be called?   |          |          | 1 |
| 9  | How many surfaces must be machined on VIEW 4?  |          |          | 1 |
| 10 | What is the thickness of the Woodruff key?   |          |          | 1 |
| 11 | Determine the dimensions at C and D.   | <b>C</b> | <b>D</b> | 2 |
| 12 | What is the size of the arc at E?  |          |          | 1 |
| 13 | What is the feature at F called?   |          |          | 1 |
| 14 | What is the feature at G called?   |          |          | 1 |
| 15 | What is the purpose of the castle nut?   |          |          | 1 |
| 16 | What is the purpose of the split pin?  |          |          | 1 |
| 17 | What type of section is indicated on VIEW 4?   |          |          | 1 |
| 18 | What is the purpose of the Woodruff key in the crank-handle assembly?                            |          |          | 1 |
| 19 | Draw the arrows for the cutting plane located on VIEW 2 and label it B-B.                        |          |          | 2 |
| 20 | In the box below (ANSWER 20), draw, in neat freehand, the symbol for the projection system used. |          |          | 4 |

ANSWER 20

TOTAL

25

MAXSTEEI

GOVAN MBEKI DRIVE  
PORT ELIZABETH

## MANUFACTURING

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

# CRANK HANDLE



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SYMBOL

EXAMINATION NUMBER

EXAMINATION NUMBER

2



QUESTION 2: LOCI (HELIX)

A manufacturing company designed a single-start square threaded worm gear with the following specifications:

- Right handed
- One and a half revolutions
- Outside diameter = 120 mm
- Core diameter = 80 mm
- Pitch = 60 mm

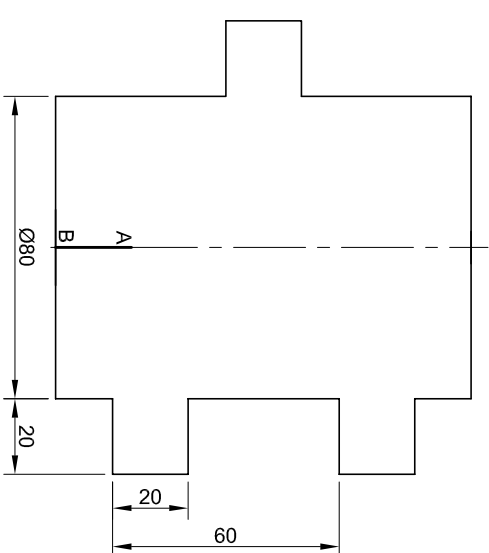
Given:

- The incomplete front view of the worm gear showing the profile of the thread and the starting position AB, at the centre front of the shaft
- The centre line and starting position AB as a reference on the drawing sheet

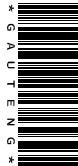
Instructions:

Draw, to scale 1 : 1, the complete front view of the worm gear using the given centre line and starting position AB.

- Show ALL necessary construction.
- NO hidden detail is required. [39]



| ASSESSMENT CRITERIA       |                  |  |  |  |
|---------------------------|------------------|--|--|--|
| 1. CONSTRUCTION           | 8 $\frac{1}{2}$  |  |  |  |
| 2. OUTSIDE CURVES + LINES | 15 $\frac{1}{2}$ |  |  |  |
| 3. INSIDE CURVES          | 6                |  |  |  |
| 4. QUALITY OF CURVES      | 4                |  |  |  |
| 5. SHAFT                  | 5                |  |  |  |
| TOTAL                     | 39               |  |  |  |
| EXAMINATION NUMBER        |                  |  |  |  |
| EXAMINATION NUMBER        |                  |  |  |  |
| 3                         |                  |  |  |  |





QUESTION 3: ISOMETRIC DRAWING

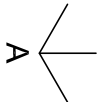
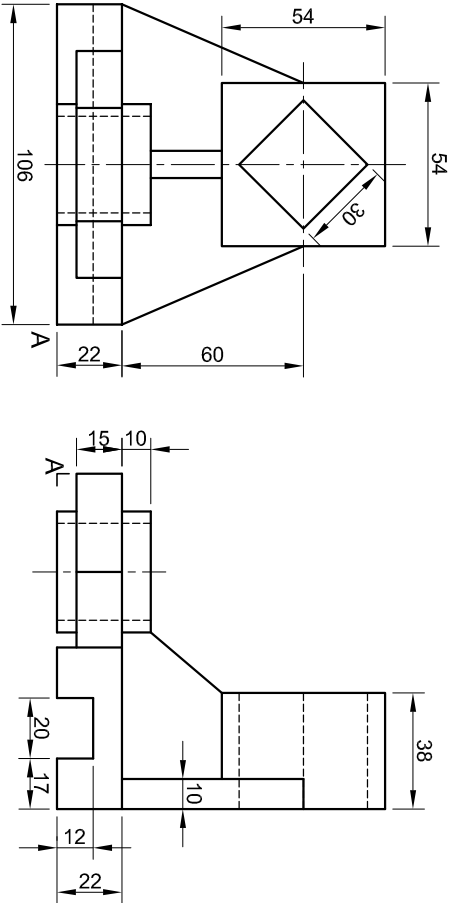
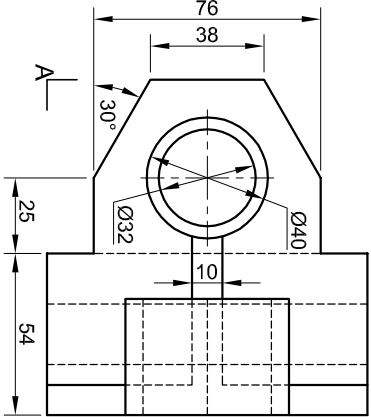
Given:

- The front view, top view and left view of a movable coupling
- The position of point A on the drawing sheet

Instructions:

Convert the orthographic views of the movable coupling into a scale 1 : 1 isometric drawing.

- Make corner A the lowest point of the drawing.
  - Show ALL necessary circle and other construction.
  - NO hidden detail is required.
- [39]



ASSESSMENT CRITERIA

|                        |    |  |  |
|------------------------|----|--|--|
| 1. AUX. VIEW + PLACING | 4  |  |  |
| 2. ISOMETRIC LINES     | 20 |  |  |
| 3. NON-ISOMETRIC LINES | 6½ |  |  |
| 4. ISOMETRIC CIRCLES   | 5½ |  |  |
| 5. CIRCLE CONSTRUCTION | 2  |  |  |
| 6. CENTRE LINES        | 1  |  |  |

TOTAL

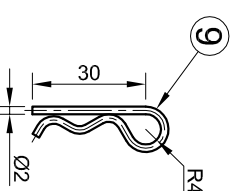
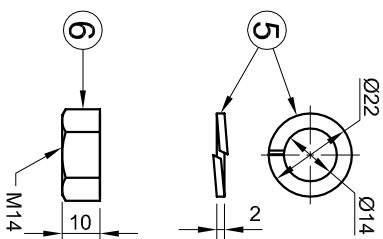
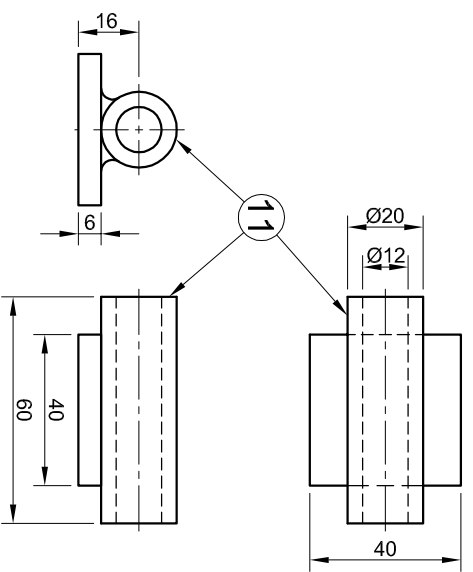
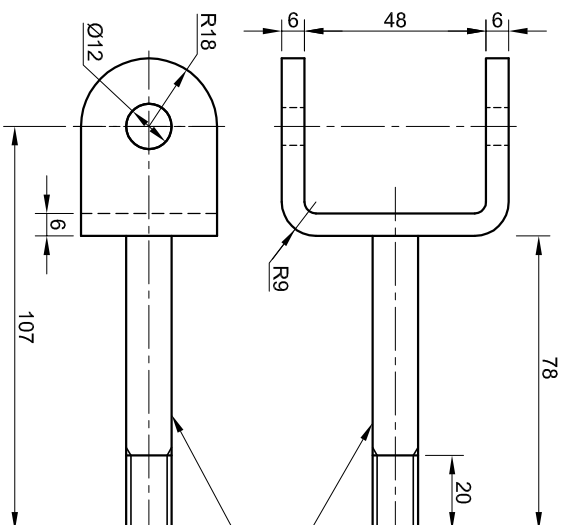
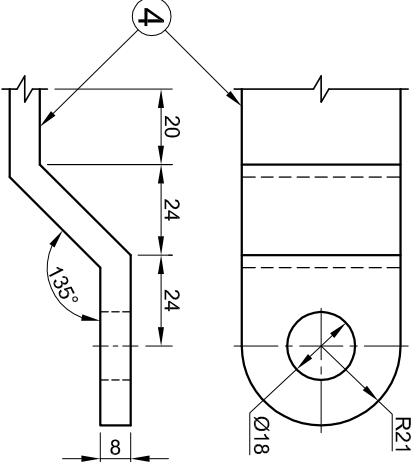
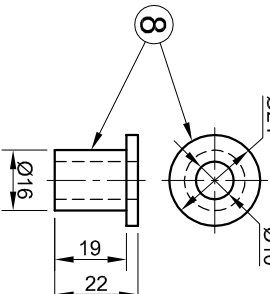
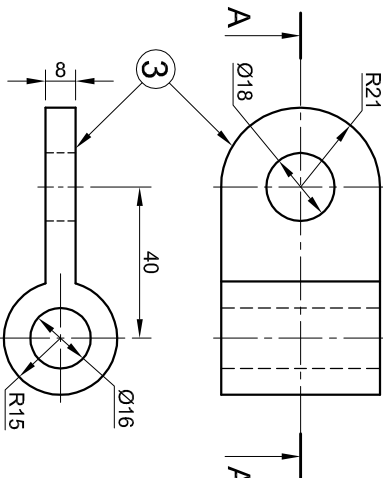
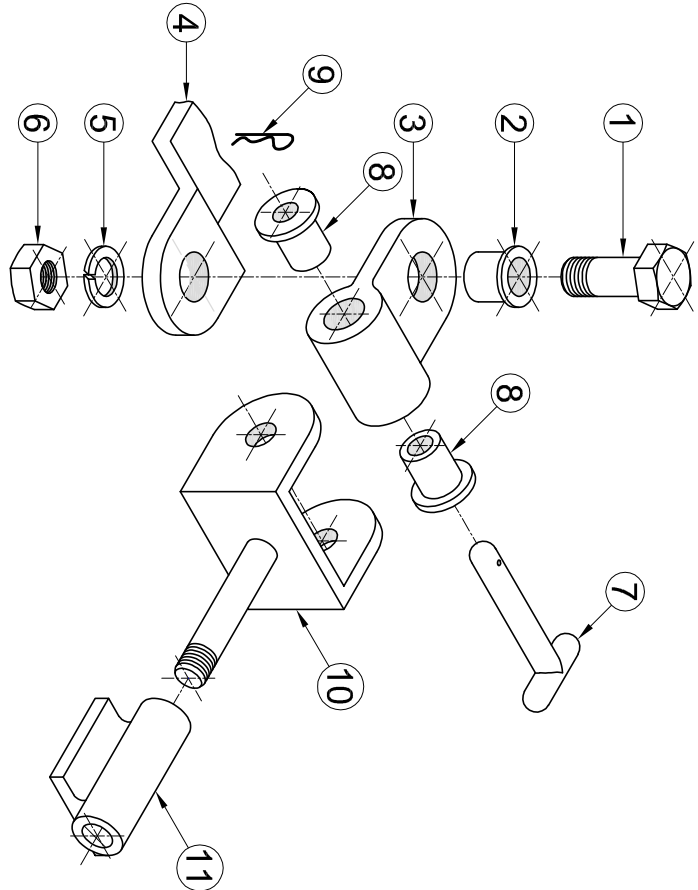
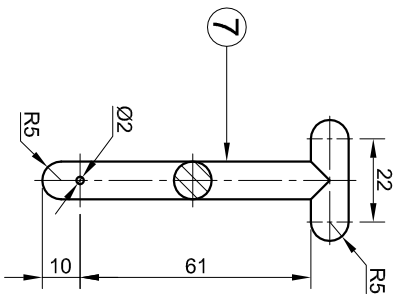
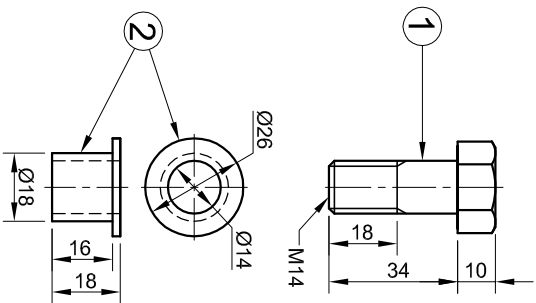
39

EXAMINATION NUMBER

EXAMINATION NUMBER

4





QUESTION 4: MECHANICAL ASSEMBLY

Given:

- The exploded isometric drawing of the parts of a coupling assembly for a trailer, showing the position of each part relative to all the others
- Orthographic views of each of the parts of the coupling assembly

Instructions:

- Answer this question on page 6.
- Draw, to scale 1 : 1 and in third-angle orthographic projection, the following views of the assembled parts of the coupling assembly:

4.1 A **sectional front view** on cutting plane A-A, as seen from the arrow shown on the exploded isometric drawing. The cutting plane is shown on the top view of the swivel (part 3).

4.2 The **top view**.

- ALL drawings must comply with the guidelines contained in the SABS 0111.

NOTE:

- Show **THREE** faces of the M14 bolt and nut and **ALL** necessary construction.
- NO** hidden detail is required.

Add the **following feature to the drawing:**

- The cutting plane A-A

[97]

PARTS LIST

| PART                 | QUANTITY | MATERIAL           |
|----------------------|----------|--------------------|
| 1. M14 BOLT          | 1        | MILD STEEL         |
| 2. BUSH              | 1        | HIGH-TENSILE STEEL |
| 3. SWIVEL            | 1        | MILD STEEL         |
| 4. FIXED ARM         | 1        | MILD STEEL         |
| 5. SPRING WASHER     | 1        | HARDENED STEEL     |
| 6. M14 NUT           | 1        | MILD STEEL         |
| 7. PIN               | 1        | HARDENED STEEL     |
| 8. BUSH              | 2        | NYLON              |
| 9. LOCKING PIN       | 1        | SPRING STEEL       |
| 10. YOKE             | 1        | MILD STEEL         |
| 11. MOUNTING BRACKET | 1        | MILD STEEL         |

|                     |
|---------------------|
| DRAWN BY: NDA/THUMO |
| DATE: 23/05/2010    |
| CHECKED BY: MARY    |

|                                    |
|------------------------------------|
| ALL DIMENSIONS ARE IN MILLIMETRES. |
| ALL UNSPECIFIED RADII ARE R3.      |
| DATE: 12/06/2010                   |
| APPROVED BY: PHATHU                |

|                               |
|-------------------------------|
| DRAWING PROGRAM: AUTOCAD 2008 |
| DATE: 05/07/2010              |
| SCALE: 1 : 2                  |

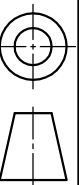
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OLD CAPE ROAD  
GREENBUSHES  
6025  
www.ibayhisteel.co.za

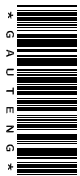


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GRADE 12 FEB./MAR. 2011



5





| ASSESSMENT CRITERIA                                     |               |          |      |          |
|---|---------------|----------|------|----------|
| TOP VIEW  |               |          |      |          |
|   | POSSIBLE<br>E | OBTAINED | SIGN | MODERATE |
| 1. M14 BOLT   | 3             |          |      |          |
| 2. BUSH   | 1             |          |      |          |
| 3. SWIVEL   | 3             |          |      |          |
| 4. FIXED ARM  | 2½            |          |      |          |
| 5. PIN  | 4             |          |      |          |
| 6. BUSH   | 2             |          |      |          |
| 7. LOCKING PIN  | 1             |          |      |          |
| 8. YOKE   | 10            |          |      |          |
| 9. MOUNTING<br>BRACKET                                  | 4½            |          |      |          |
| SUBTOTAL  | 31            |          |      |          |
| SECTIONAL FRONT VIEW                                    |               |          |      |          |
| 1. M14 BOLT   | 10½           |          |      |          |
| 2. BUSH   | 3½            |          |      |          |
| 3. SWIVEL   | 3½            |          |      |          |
| 4. FIXED ARM  | 4             |          |      |          |
| 5. SPRING WASHER  | 2½            |          |      |          |
| 6. M14 NUT  | 5             |          |      |          |
| 7. PIN  | 1             |          |      |          |
| 8. YOKE   | 9             |          |      |          |
| 9. MOUNTING<br>BRACKET                                  | 4             |          |      |          |
| SUBTOTAL  | 43            |          |      |          |
| GENERAL   |               |          |      |          |
| THIRD ANGLE   | 2             |          |      |          |
| ◇ CENTRE LINES  | 3             |          |      |          |
| ⊗ SECTION A-A   | 4             |          |      |          |
| ▲ HATCHING  | 9             |          |      |          |
| ASSEMBLY<br>‡ MARK OF EVERY PART<br>CORRECTLY ASSEMBLED | 5             |          |      |          |
| SUBTOTAL  | 23            |          |      |          |
| TOTAL   | 97            |          |      |          |
| EXAMINATION NUMBER                                      |               |          |      |          |
| EXAMINATION NUMBER                                      |               |          |      |          |

|                    |   |
|--------------------|---|
| EXAMINATION NUMBER |   |
| EXAMINATION NUMBER | 6 |

