higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T620(E)(J21)T
AUGUST EXAMINATION

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N1

(11021871)

21 July 2014 (Y-Paper)
13:00–16:00

This question paper consists of 8 pages and 1 formula sheet.

ENGINEERING

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
FITTING AND MACHINING THEORY N1
TIME: 3 HOURS
MARKS: 100

NOTE: If you answer more than the required number of questions, only the required number of questions will be marked. All work you do not want to be marked must be clearly crossed out.

INSTRUCTIONS AND INFORMATION

1. ALL the questions in SECTION A must be answered, except QUESTION 1 where either QUESTION 1.1 or QUESTION 1.2 must be answered.
2. Answer any FOUR questions in SECTION B.
3. Read ALL the questions carefully.
4. Number the answers correctly according to the numbering system used in this question paper.
5. All the sketches must be neat, reasonably large and in good proportion.
6. All sketches must be labelled.
7. Write neatly and legibly.

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SECTION A: GENERAL PRACTICE

ALL the questions in this section must be answered, except QUESTION 1, where either QUESTION 1.1 or QUESTION 1.2 must be answered.

QUESTION 1: OCCUPATIONAL SAFETY

1.1 Name FIVE safety precautions to bear in mind when using hand tools.

OR

1.2 Briefly describe the following regulation as applicable to the Minerals Act, 1991 (Act 50 of 1991).

Regulation 4.7.1 Intoxicated person.

[5]

QUESTION 2: MEASURING INSTRUMENTS

2.1 Make a neat, enlarged drawing of only the reading of the following measuring instruments:

2.1.1 A metric depth micrometer 6, 46 mm

2.1.2 A vernier caliper gauge 5,26 mm

(2 x 4) (8)

2.2 State TWO practical uses of a dial test indicator. (2)

2.3 Name the degree of accuracy of a vernier height gauge. (1)

[11]

QUESTION 3: SCREW THREADS

3.1 In practice various types of screw threads are used for specific purposes.

Name THREE of these different screw threads known to you and also name the included angle of each. (3)

3.2 Explain the difference between a single–start screw thread and a multi-start screw thread. (2)

3.3 Calculate the depth of M20 x 2,5 screw tread, M20 being the diameter and 2,5 being the pitch in millimetres (1)

[6]

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QUESTION 4: HANDTOOLS

4.1 When you buy a new file, you must name the characteristics of that specific file. It is called the classification of a file.

State the FOUR classification factors. (4)

4.2 What advantages does the extension piece give the socket and the ratchet wrench? (1)

4.3 Explain how the tension is adjusted on a hacksaw blade. (1)
[6]

QUESTION 5: METALS AND PLASTICS

5.1 Choose a description from COLUMN B that matches a metal item in Column A. Write only the letter (A–F) next to the question number (5.1.1–5.1.5) in the ANSWER BOOK.

A=METALS	B=COMPOSITION, PROPERTIES & USES
5.1.1 Aluminium	A. difficult to deform with a hammer
5.1.2 Zinc	B. consist of copper and tin
5.1.3 Solder	C. very light and used for motor vehicle parts
5.1.4 Stainless steel	D. corrosion resistant and used on roof sheets
5.1.5 Bronze	E. low melting point and used to join electrical wires
	F. high tensile strength and is light

(5)

5.2 Give FIVE alloying elements that can be added to steel to give it a specific property. (5)

5.3 We use nylon in engineering because it has specific properties.

Name THREE of these properties. (3)
[13]

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QUESTION 6: MARKING OFF

Explain the function of the following marking-off equipment

6.1 Dotting punch.

6.2 Heigh gauge

6.3 Scriber

6.4 Angle plate.

(4 x 1) [4]

QUESTION 7: KEYS AND KEYWAYS

7.1 Calculate the height, the width and the length of a feather key, when a 45 mm diameter shaft must be keyed to a pulley. (3)

7.2 Draw a neat drawing of the above calculated feather key with its dimensions. (3)
[6]

QUESTION 8: FASTENERS

Name FOUR locking methods for nuts, where vibration is present. [4]

QUESTION 9: HAND TAPS, STOCKS AND DIES AND REAMERS

Study FIGURE 1 below and label the parts by writing down the names of the different types of dies and reamers used in industry, next to the letters (A–E) in the ANSWER BOOK.

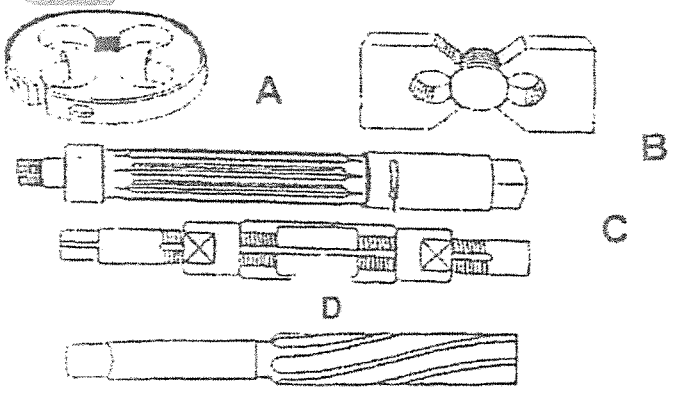

FIGURE 1

[5]

TOTAL SECTION A: 60

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SECTION B: MACHINE CUTTING TOOLS AND MACHINES

Answer any FOUR questions in this section

QUESTION 10: DRILLING MACHINES

10.1 Describe THREE factors of a drill point, to be taken into account to perform a drilling operation efficiently. (3)

10.2 Name THREE methods that can used to clamp a work piece on a drilling machine table. (3)

10.3 Briefly describe how the spindle speed on the sensitive drilling machine can be changed. (1)

10.4 The following details are known to an apprentice:

The drill diameter - 14 mm
The number of holes to be drilled – 6
The cutting speed of steel is 30 m/min.

Calculate the spindle speed in revolutions per min to drill the six holes. (3)
[10]

QUESTION 11: GRINDING MACHINES AND MACHINE CUTTING

11.1 State FIVE factors to be considered before selecting a grinding wheel for a specific job. (5)

11.2 FIGURE 2 indicates certain centre lathe cutting tools. Write down the names of each cutting tool next to the letters (A–E) in the ANSWER BOOK.

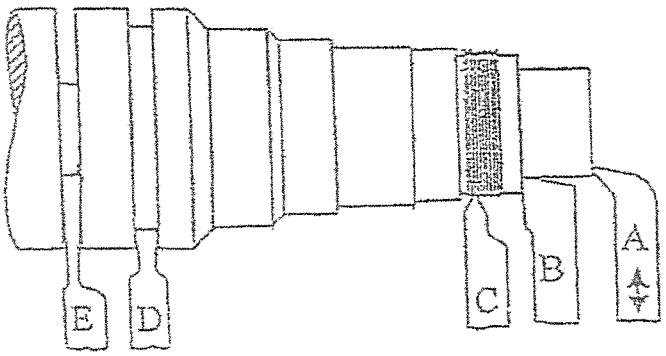

FIGURE 2

(5)
[10]

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QUESTION 12: SHAPING MACHINES

12.1 Study FIGURE 3 below and label the parts by writing down the names of the components of the Ram head next to the letters (A–E) in the ANSWER BOOK.

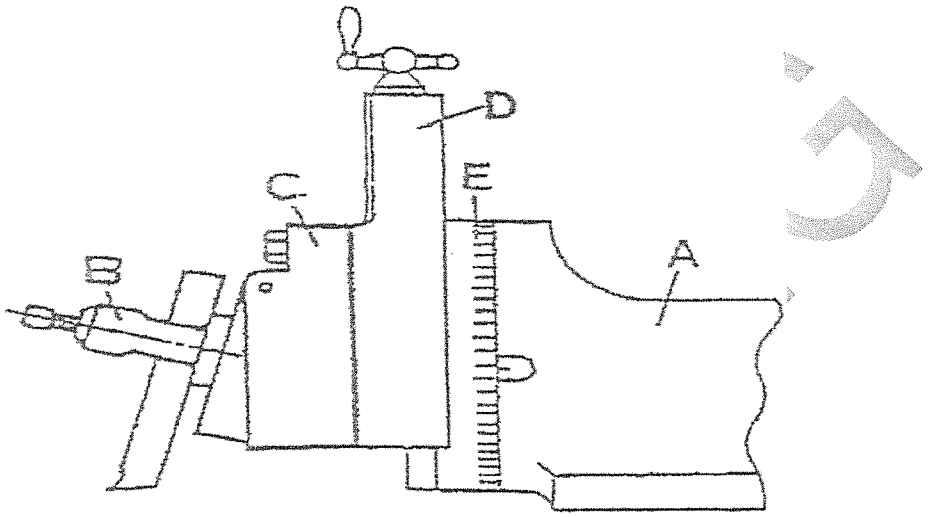

FIGURE 3 (5)

12.2 You are given a task to machine a cast iron base, 295 mm long x 180 mm wide on a shaping machine in the machine shop. The following details are given to you:

- Stroke length for the for the work piece =320 mm
- Cutting speed for the material =12 m per minute
- Feed for roughing cut = 3 mm per stroke
- Feed for finishing cut = 1,2 mm/stroke
- Stroke ratio = 2:1
- Finishing cut time = 4 minutes 48 seconds
- Setting up time = 10 minutes

Calculate the following:

12.2.1 The strokes per minute (2)

12.2.2 The roughing cut time (2)

12.2.3 The total time to complete the work piece (1)
[10]

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QUESTION 13: CENTRE LATHE

13.1 Describe the purpose of a gap bed on a centre lathe in the machine shop. (1)

13.2 Study FIGURE 4 below and label the parts of the tail stock of a centre lathe by writing down the names next to the letters (A–D) in the ANSWER BOOK

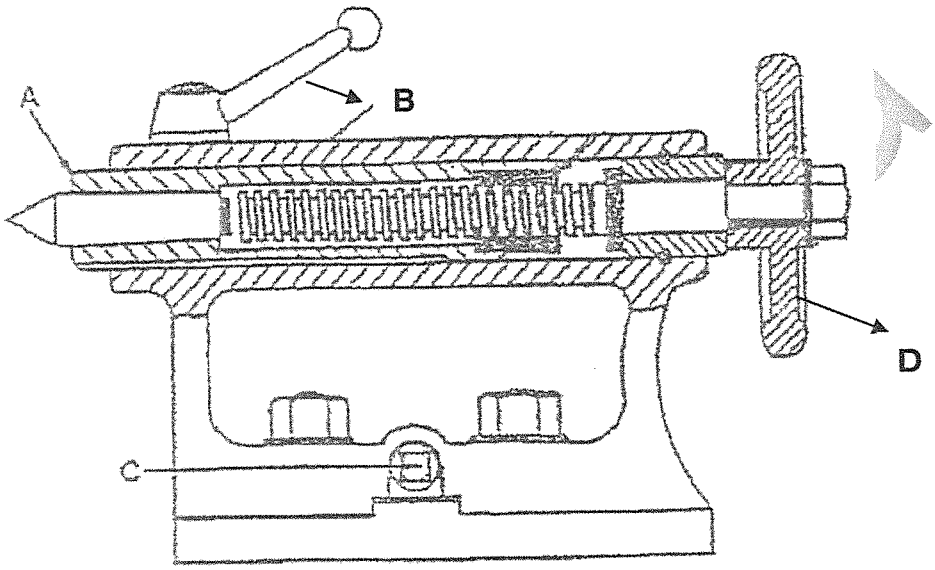

FIGURE 4 (4)

13.3 State the purpose of the half nut and name also the type of screw thread it is made up of when using the centre lathe. (2)

13.4 State TWO disadvantages of the CMC lathe compared to the conventional lathe in a machine shop. (2)

13.5 State ONE function of a pipe centre as used on a centre lathe. (1)
[10]

QUESTION 14: THE MILLING MACHINE

14.1 State TWO safety precautions applicable when working on a milling machine. (2)

14.2 Name FOUR components you would find on a milling machine and describe the function of each. (8)
[10]

TOTAL SECTION B: 40
GRAND TOTAL: 100

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FORMULA SHEET

Any applicable formula may also be used.

1. $V = \pi \times D \times N$

2. $w = feed/stroke \times strokes/min \times t$
   $w = toevoer/slag \times slae/min \times t$

3. $$Strokes/min = \frac{S}{Length\ of\ stroke} \times Ratio$$

   $$Slae/min = \frac{S}{Lengte\ van\ slag} \times Verhouding$$

4. $$h = \frac{D}{6}$$

5. $$w = \frac{D}{4}$$

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MARKING GUIDELINE

NATIONAL CERTIFICATE

AUGUST EXAMINATION

FITTING AND MACHINING THEORY N1

21 July 2014

This marking guideline consists of 8 pages.

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QUESTION 1

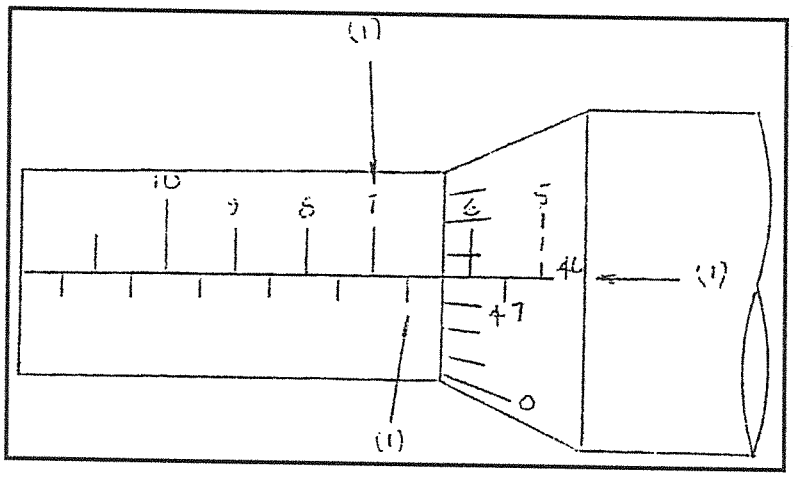
1.1 Use each tool to do the task it is meant for
Keep the sharp edges of tools pointed away from you towards the back of your work bench.
Keep your tools clean , dry and free of oil.
Take care of your tools, e.g. have a storage place for each tool and service them regularly.
Never carry tools which have sharp edges in your pocket.
Do not use your tools incorrectly or carelessly.

OR

1.2 No person in a state of intoxication or in any other condition which may render or be likely to render him incapable of taking care of himself or of a person in charge ,shall be allowed to enter the workings of a mine or be in the proximity of any workplace or near any machinery on the surface of a mine or at the works , and any person who may have entered the workings of a mine or who is found in the proximity of any workings in a state of intoxication may be arrested immediately by the manager or some person duly appointed by him and immediately handed over to the police and shall be deemed to be guilty of an offence under these regulations.

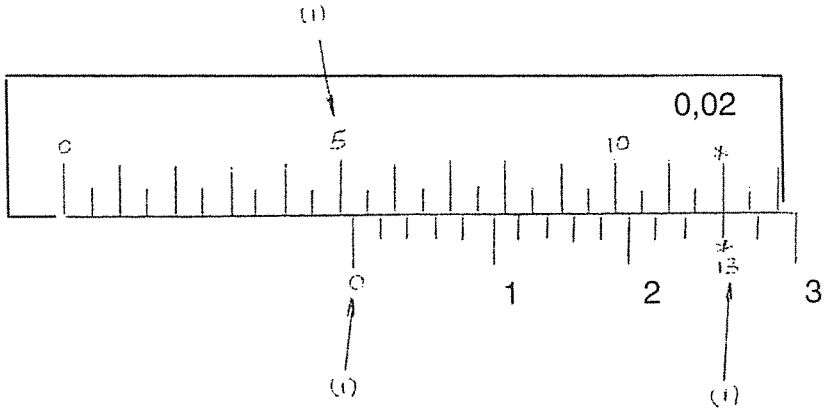
(Any 5 x 1) (5)
[5]

QUESTION 2



2.1 Metric depth gauge (4)

Vernier Calliper gauge (Neatness 1 mark) (4)



2.2
1. Setting up work pieces accurately in a machine.
2. Setting up work pieces accurately prior to marking off.
3. Testing rectangular work pieces for parallelism.
4. Testing for roundness.
5. Testing for concentricity.
6. Testing for limits of size. (Any 2 x 1) (2)

2.3 0,02 mm (1)
[11]

QUESTION 3 SCREW THREADS

3.1
1. V–Thread 60 degrees
2. Square thread 90 degrees
3. Acme thread 29 degrees
4. Trapezium 45˚
5. V-thread imperials 55˚ (3)

3.2 Single start screw thread = is a single helical groove cut in a rod.
Multi start screw thread = is two or more helical grooves cut in a rod. (2)

3.3 D=0,613 x P
=0,613x2,5
=1,53mm (1)
[6]

QUESTION 4 HAND TOOLS

4.1
1. The type of cut
2. The cross-cut profile
3. The length
4. The degree of coarseness (4)

4.2 Extension pieces increase the reach of the socket in difficult areas, deep down a hole or recess where other spanners cannot be used (1)

4.3 Take up the slack and then two or more complete turns of the wing nut. (1)
[6]

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QUESTION 5 METALS AND PLASTICS

5.1 A Aluminium = very light and used for motor vehicle parts.
B Zinc = corrosion resistant and used on roof sheets
C Solder = low melting point and used to join electrical wires
D Stainles steel= difficult to deform by a hammer.
E Bronz = consists of copper and tin. (5)

5.2 Carbon , Manganese , Nickel , Chromium , Vanadium , Tungsten , Kobalt , Molybdenum. (5)

5.3
- No need for a lubricant
- Maintenance free
- Very light in weight
- Easily machineable
- Can withstand a lot of shock.

(3)
[13]

QUESTION 6 MARKING OFF

6.1 6.1 To punch dots on the scribed cross lines.

6.2 To scribe horizontal lines on metal.

6.3 To scribe lines on metal with the aid, for example, of a square.

6.4 To support the the workpiece for mark off

(4 x 1) **[4]**

QUESTION 7 KEYS AND KEY WAYS

7.1 $$H = \frac{D}{6} = \frac{45}{6} = 7,5 \text{ mm}$$

$$W = \frac{D}{4} = \frac{45}{4} = 11,25 \text{ mm}$$

L=1,5D
=1,5x45
=67,5 mm

(3)

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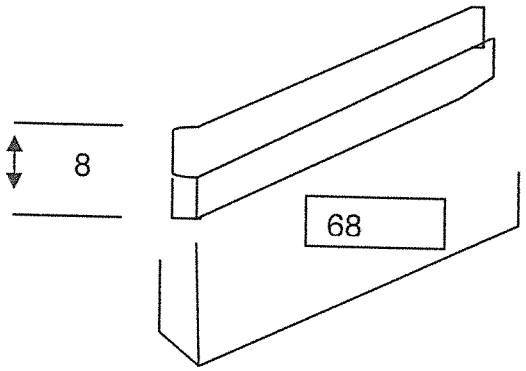
7.2



(3)
[6]

QUESTION 8 FASTENERS

Locknuts
Castlenut & splitpin
Tab washer
Spring washer
Locking plate
Star washer

(Any 4 x 1) [4]

QUESTION 9 HAND TAPS , STOCKS , DIES AND REAMERS

A – Circular split die
B - Two piece rectangular die
C - Expanding reamer
D - Adjustable reamer
E - Hand reamer

[5]

TOTAL SECTION A: 60

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SECTION B : MACHINE CUTTING TOOLS AND MACHINES

ANSWER ANY FOUR OF THE FOLOWING QUESTIONS IN THIS SECTION

QUESTION 10

10.1
- Must have a clearance angle
- Angle both sides must be equal (59°)
- Cutting edges must be of equal length
- Cutting point must be of same length
- Web angle must be between cutting 120°-130°
- Edge must be sharp

(Any 3 x 1) (3)

10.2 Machine vice
Angle plate
V–blocks
Clamps (3)

10.3 The spindle speed can be changed by adjusting the position of the V-belt on the stepped pulleys (1)

10.4 $S=\pi dn$

$N=\frac{S}{\pi D}$

$=\frac{30}{\pi x}$

=682.1 r.p.m (3)

[10]

QUESTION 11 GRINDING MACHINES AND MACHINE CUTTING TOOLS

11.1 The material you have to grind and its hardness
The amount of material you must remove and the finish you require
Whether you have to do wet or dry grinding
The speed of the wheel
The area of the grinding operation
The severity of the grinding operation (Any 5 x 1) (5)

11.2 A – Side roughing tool-facing tool
B – Knife tool to cut diameters.
C – Screw cutting tool
D – Grooving tool or parting tool.
E – Parting tool (5)

[10]

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QUESTION 12

12.1
A – Ram
B – Tool holder
C – Clapper box
D – Tool head
E – Protractor scale

(5)

12.2
Width = 180 mm
Length of stroke = 320 mm
Cutting speed = 12 m per stroke
Feed for rough cut = 3 mm per minute
Feed for finishing cut = 1,2 mm per stroke
Stroke ratio = 2 : 1
Finishing cut time = 4 minutes 48 sec
Setting up time = 10 minutes

12.2.1

$$\text{Strokes per minutes} = \frac{\text{Cutting speed (m/min x ratio}}{\text{Length of stroke (m)}}$$

$$= \frac{12 \text{ m per minute} \times 2}{0,32 \text{ m} \quad 3}$$

$$= 37,5 \times 0,667$$

$$= 25,013 \text{ strokes / minutes}$$

(2)

12.2.2 12.2.2 Rough time

$$= \frac{\text{width (mm)}}{\text{Feed x strokes per minute}}$$

$$= \frac{180 \text{ mm}}{3 \text{ mm/min} \times 25,013}$$

$$= 2,398 \text{ minute}$$

(2)

12.2.3 Total time is 2,398 min + 4,8 min = 7,198 Minutes (1)

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QUESTION 13 CENTRE LATHE

13.1 To allow bigger work pieces that can normally not swing over the bed to be machined (1)

13.2 A – The centre, to supporting a long work piece
B – Locking level, to lock spindle
C – Adjusting screws to move tailstock across its own bed
D – Handle to turn spindle forward and backwords
(4)

13.3 When engaged it grips onto the lead screw while cutting screw threads on the lathe.
Acme thread (2)

13.4 The set up time to manufacture one part is a loss
It is more expensive
It costs a lot to repair (2)

13.5 Pipe centre – used to support pipes, tubes and work pieces with large holes in their ends. (1)
[10]

QUESTION 14 MILLING MACHINE

14.1 - Wear proper clothing and approved safety goggles
- Never reach over or near the rotating cutter
- Keep your eyes focussed on the cutting process
- Make sure the feed is not too fast (Any 2 x 1) (2)

14.2 Spindle – provides drive to the arbor and cutters
Arbor – drives and holds the cutters in the correct position
Arbor support – fits and clamps the over arm to align and support the arbor
Over arm – provides support and correct alignment for the arbor
Column – Supports and guide the knee vertically
Table trips – Trip the automatic feed at pre-set positions
Adjustable footstock – support the work piece on the opposite side of the dividing head
Bracing arms – provide better support to the arbor and prevents vibration and chatter when heavy cuts are made (8)
[10]

TOTAL SECTION B: 40
GRAND TOTAL 100

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