Practice Aptitude Quiz

Metal Fabrication

Part 1:   About this Metal Fabrication Resource

Guidance

This Practice Aptitude Quiz is intended to be a general illustration of some of the key learning standards required of people attempting an Australian Apprenticeships entry level qualification in Metal Fabrication.

This Practice Aptitude Quiz is neither a formal assessment tool nor a direct pre-requisite for any job application.

This quiz has been developed with the assistance of Industry and Registered Training Organisations based on the needs and requirements of the industry sector.

It focuses on literacy, numeracy, comprehension and problem solving questions contextualised to this specific industry.

This Practice Aptitude Quiz does not cover aspects such as general knowledge or complex problem solving or reasoning skills. The level of reading, writing and mathematical skills assessed by this quiz is equivalent to that of a young person at Year 11 level.

This resource can be used by a number of different organisations and people such as careers practitioners with young people, Group Training Organisations and Job Services Australia providers with job seekers.

The Practice Aptitude Quiz can be:

> Used by careers practitioners with individuals or in a class setting to provide general guidance on the level of study involved in undertaking an entry level qualification in this industry;

> Provided to people to enable them to practice their skills before sitting an actual aptitude test;

> Used by teachers as a guide to industry math requirements at the entry point of this particular Australian Apprenticeship career path; and

> Used by teachers as classroom based activities for students in Year 11 and 12 and VET Business-centred studies.

Please note that rates quoted in this assessment for various items, including pay rates, are not meant to reflect today's values, but are used purely for mathematical purposes.

The quiz should be able to be completed in approximately 1 hour and 30 minutes.

Calculators may be used to complete this practice exercise.

Answers are located at the end of the quiz.

Metal Fabrication Career, Occupational Information and Job Hunting Resources

Information and links on the Metal Fabrication, careers, job prospects as well as career websites and job hunting resources can be found at www.aapathways.com.au/Career-Resources.

After the Quiz

There are a range of support services available to help you find out about courses
that may help you improve your literacy and numeracy skills and also your readiness for work.

If you are still at school you should discuss any concerns you may have with your career practitioner.
Further information may also be provided by a Job Services Australia provider, an Australian
Apprenticeships Centre, a Group Training Organisation or a training provider.

Useful Contacts

Here are some links to job seeker support services:

> Search for your local Australian Apprenticeships Centre - www.aapathways.com.au/aac

> Find a local Group Training Organisation - www.grouptraining.com.au/Find/find_gto.html

> Job Services Australia providers work with eligible job seekers to develop an individually tailored
Employment Pathway Plan. The plan maps out the training, work experience and additional
assistance needed to find job seekers sustainable employment - www.jobsearch.gov.au/provider/
default.aspx

QuiZ

Section 1 - Literacy, Reading and Comprehension

1. a. **Change these following words into plurals.**

    Address   _____

    Welder   _____

    Fix   _____

    Lunch   _____

    Finish   _____

    b. **Write these abbreviated words in full.**

    Dr   _____

    Wed   _____

    Jan   _____

    mm   _____

    LOL   _____

2. **Metal Fabrication uses a number of different industrial gases. Write the following gases in alphabetical order in the column below.**

    Oxygen   Argon   Hydrogen   LPG (Liquid Petroleum Gas)
    Nitrogen   Acetylene   Helium   Carbon dioxide

3. **Read the following text. In each paragraph there are seven spelling or grammar errors. Correct those errors and list them in the order they appear.**

About the Metal Fabrication Trade:

The Metel Fabrication trade offers diverse opportunities in career development. Sume of the key attributes an employur may look four in an applicant are: reliability; self-motivation; and eagerness to lern. The traditional avenue to become a tradespersan in Metal Fabrication is though an Australian Apprenticeship.

If you are a persan who enjoys phisical and practical tasks, working with your hands, and you can operate in challenging environments and keep up with advencing technology, this trade may suit you. Apprentices develop a range of technical knowledge and organisational skills. Apprentices learn how to safly operate tools, reed technical drawings, work with indstrial machinery, and also to operate welding equipment end thermal cutting equipment.

Once you hav obtained your trede qualifications you have opportunities to enhance your skils and knowladge through post trade studies soch as a Diploma in Engineering, for example. It all depends on where your interast develops and whot part of the trade you wish to focus on.

Paragraph 1	Paragraph 2	Paragraph 3

Comprehension

4. **Read the following information and answer the questions that follow.**

The principle of thermal cutting in the Metal Fabrication industry.

A Metal Fabricator Tradesperson is required at times to work with thermal cutting/gouging equipment such as plasma, fuel gas cutting, gouging and heating equipment to assist in the manufacture of metal products.

Flame cutting principally uses the burning of a gas mixture to generate heat. The mixture often used is oxygen and a fuel gas such as acetylene or LPG(Liquefied Petroleum Gas). The process is also commonly known by such names as oxy-cutting and thermal cutting.

The process used for flame cutting steel depends on a chemical reaction known as oxidisation between heated iron and a pure oxygen jet. When a piece of steel is heated to an ignition temperature of 815°C, and a jet of pure oxygen is released under the operator's control, the iron in the steel will burn to form a substance called iron oxide. The ignition temperature at which the

chemical reaction begins for low carbon steel is 815°C. This is well below its melting temperature which is about 1,450°C.

The chemical reaction generates a great deal of heat. Once the metal begins to burn, the heat generated will lead to a spread of oxidisation through the material. This heat enables the cutting to continue and pierce thick steel sections without overall heating of the metal.

One of the important properties of flame cutting is that the steel contains iron. So for non-ferrous metals, that is metals that contain no iron, the plasma arc torch is used for cutting and gouging to overcome the lack of iron.

Questions

a.   **For flame cutting/gouging the most common gas combinations used are: (Circle the correct response)**

   i.   Helium Oxygen and Carbon Dioxide gases
   Iii.   Oxygen and Acetylene or Oxygen & LPG
   iii.   Oxygen, Carbon Dioxide and Hydrogen gases
   iv.   Hydrogen Carbon Dioxide and Argon gases

b.   **The flame cutting of steel depends on a chemical reaction known as oxidisation. This reaction occurs between: (Circle the correct response)**

   i.   Heated pure Oxygen jet and Carbon
   ii.   Heated steel and Acetylene gas
   iii.   Heated iron and LP gas
   iv.   Heated Iron and pure Oxygen jet

c.   **The temperature oxidisation occurs at is known as: (Circle the correct response)**

   i.   Oxidisation temperature
   ii.   Melting temperature
   iii.   Ignition temperature
   iv.   Burning temperature

d.   **The ignition temperature at which oxidisation occurs is: (Circle the correct response)**

   i.   723°C
   ii.   1450°C
   iii.   950°C
   iv.   815°C
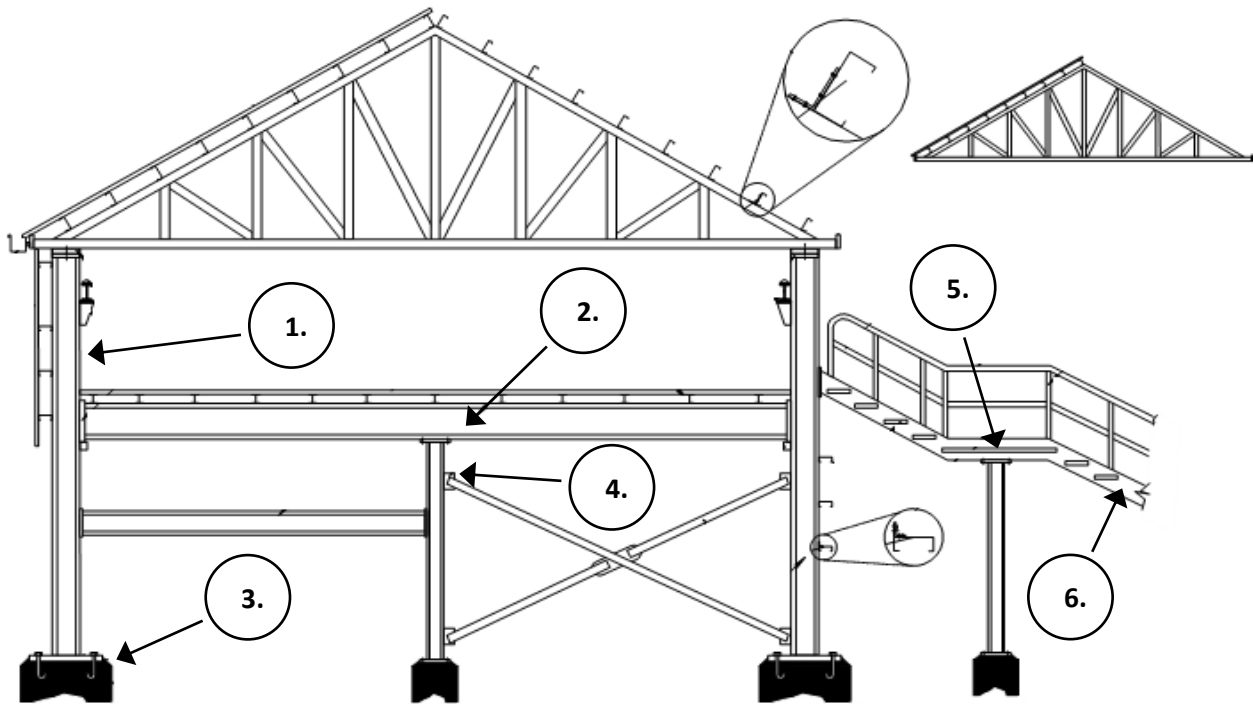
**Look at this diagram of the components of a steel framed building.**

Metal fabricators are often required to fabricate and assemble various steel structural joints and sections. It is important that the fabricator has an understanding of the terminologies used in the naming of particular components in these steel structures.

1. **Locate the building component numbers from the drawing supplied above and place that number adjacent to what you consider to be the correct description of that building component.**

| Item No.		Name/Description
a. _____	=	Base plate - welded to the base of the column member and secured to the footing
b. _____	=	Column - vertical support member of a building frame
c. _____	=	Gussets - plates which connect cross braces to columns
d. _____	=	Stair stringers - side members which support stair treads
e. _____	=	Girder/Beam - the horizontal beam which carries loads and connects column to column
f. _____	=	Landing - the flat area between flights of stairs

Hand and power tools

Displayed below are common hand and power tools operated by a metal fabrication tradesperson.
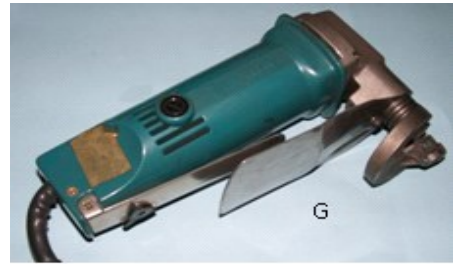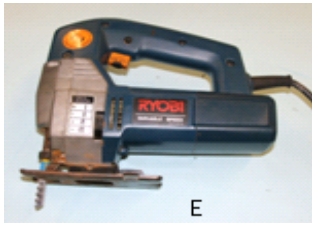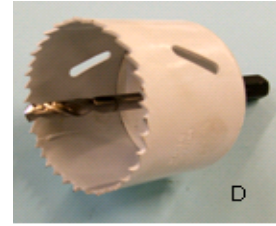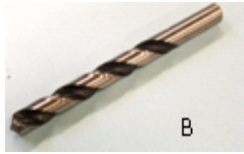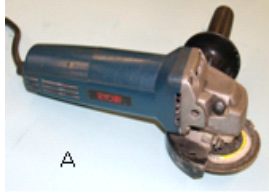
2.   Write the letter that corresponds to the description of that tool.

Letter		Description (name)
_____	=	Electric sheet metal sheerer
_____	=	Electric angle grinder
_____	=	Electric hand drill (pistol drill)
_____	=	Straight shank twist drill bit
_____	=	Hole saw bit
_____	=	Electric jig saw
_____	=	Electric sheet metal nibbler

3.   Circle the correct name of each hand tool illustrated below.
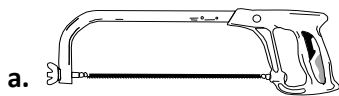
a.
i.   Coping saw
ii.   Hack saw
iii. Mortar and tannin saw
iv. Sabre saw

b.
i.   Grip clamp
ii.   Multi grips
iii. Plies grips
iv. Self-locking pliers

c.
i.   Double open end spanner
iii. Crow foot spanner
iii. Double end ring spanner
iv. Ratchet spanner

4. Micrometres are measuring devices that are used for accurate measurement to 0.01 mm, choose the correct reading of the micrometre displayed underneath. (Circle the correct response)
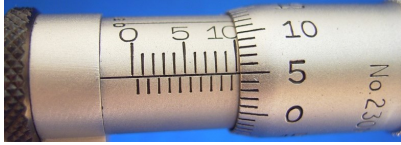
a. 10 mm   **b.** 10.05 mm   **c.** 10.55 mm   **d.** 10.5 mm

Tabulation and chart reading

Gauges are used to hold high cylinder pressures to a constant adjustable working pressure. Metal Fabricators are required to read and set regulators pressures to the correct gauge reading.

5. Referring to the gauge below, if the needle was pointing to '20' on the outside scale, what would be the nearest inside scale reading? (Circle the correct response)

a. 220

b. 240

c. 260

d. 280

6. The Tapping Chart shown is used to provide information on different threads and pitch types available as well as what size drill you are required to use to tap a thread.

Referring to the chart, what is the drill size preferred for a M5 x 0.8 pitch thread? (Circle the correct response)

a. 4.3 mm

b. 3.8 mm

c. 5.0 mm

d. 4.5 mm

METRIC ISO COARSE			
		Tapping drill sizes	
Diameter	Pitch	Preferred	Alternative
mm	mm	mm	mm
2.0	0.40	1.65	1.6
2.5	0.45	2.1	2.05
3.0	0.50	2.55	2.5
3.5	0.60	2.95	2.9
4.0	0.70	3.4	3.3
4.5	0.75	3.8	3.7
5.0	0.80	4.3	4.2
6.0	1.00	5.1	5.0
7.0	1.00	6.1	6.0
8.0	1.25	6.9	6.8

7. **Read the following item about Personal Protective Equipment (PPE).**

Personal protective clothing, hand protection, foot protection and respiratory protective equipment are often necessary in the Metal Fabrication sector.

Personal Protective Equipment (PPE) includes clothing, equipment and substances designed to be worn or used to protect people from risks of injury or disease.

PPE is only to be used in the workplace where it is not reasonably practicable to control hazards by other means.

The following information describes <u>some</u> PPE used to guard workers against specific hazards.

Gloves	Breathing Mask	Goggles
Photo A	Photo B	Photo C

Sign A	Sign B	Sign C	Sign D
THIS IS A HARD HAT AREA SAFETY HELMETS MUST BE WORN	FOOT PROTECTION MUST BE WORN IN THIS AREA	FACE SHIELD MUST BE WORN IN THIS AREA	HEARING PROTECTION MUST BE WORN IN THIS AREA

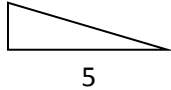| Part of Body	Some Potential Hazards
Head	Falling objects
Face & Eyes	Sparks, ultraviolet light, metal shards, chemical splashes, fumes
Hearing	Excessive noise
Respiratory	Dust, fumes, vapours
Hands	Abrasion, sparks, irritant substances, vibration , electric shock
Feet	Crushing, slipping, abrasion, irritant substances, wetness, electric shock, static electricity, puncture, cold/heat

Questions

a. Using an angle grinder can produce sparks that have the potential to damage eyes. What PPE could be used to guard against this hazard? (Note: there may be more than one PPE that can be used in this case).

_____

b. If you are lifting heavy objects there is a risk of dropping the load on your feet. What PPE could be used to help prevent injuring your feet?

_____

c. Some workplaces use chemical agents to maintain or clean equipment. What two PPE could be used to protect you from inhaling chemical fumes and prevent contact between the chemicals and your hands?

_____

d. Some machinery operates at high noise levels. What PPE can help to protect a worker's hearing in these types of situations?

_____

8. Metal Fabrication Workers rely on drawings and plans as a way of assisting
    with communication. Drawings often display symbols and abbreviations so the drawing is not
    filled up with a lot of writing. Match the symbols and abbreviations in the correct order.

|	Symbol or abbreviation	Correct Description for items	Description
a.	Ø	_____	Radius
b.	PCD	_____	Slope ratio and its direction
c.	(758)	_____	Diameter
d.	R	_____	Not to scale
e.	73 ± 0.5	_____	Reference measurement
f.	NTS	_____	Pitch circle diameter
g.	1 ╲ 5	_____	Bilateral tolerance

9. From the chart below identify the dimensions for a 250 mm Parallel Flange Channel (PFC).

Desig-nation	Mass per metre	Depth of Section	Flange		Web Thick-ness	Radius Root	Depth Between Flanges	d_1	$(b_f t_w)$	Gross area of Cross Section	Coordinate of Centroid	Gauge line
			Width	Thickness								
	d	b_f	t_f	t_w	r	d_1	t_w	t_x	A_g	X_L	g	
	kg/m	mm	mm	mm	mm	mm	mm			mm^2	mm	mm
380 PFC	55.2	380	100	17.5	10	14.0	345	34.5	5.14	7030	27.5	55
300 PFC	40.1	300	90	16	8	14.0	268	33.5	5.13	5110	27.2	50
250 PFC	35.5	250	90	15	8	12.0	220	27.5	5.47	4520	28.6	50
230 PFC	25.1	230	75	12	6.5	12.0	206	31.7	5.71	3200	22.6	45
200 PFC	22.9	200	75	12	6	12.0	176	29.3	5.75	2920	24.4	45
180 PFC	20.9	180	75	11	6	12.0	158	26.3	6.27	2660	24.5	45

Table title: PARALLEL FLANGE CHANNELS - Dimensions and properties

a. Identify the dimensions for a 250 mm Parallel Flange Channel:

g = _____

d = _____

t_w = _____

r = _____

t_f = _____

b_f = _____

b. Looking at the chart above and the diagram below what does the abbreviation "d" represent ?

_____
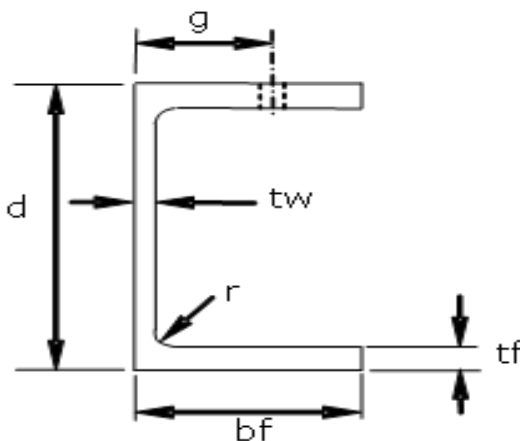
Section 3 - Mathematics

Numbers, calculations, angles, averages and fractions

1. **Work out the answers to these sums listed below.**

    Addition   **Subtraction**

    a.   1353   **b.**   238   **c.**   799   **d.**   12655
           +   447   + 589   - 233   - 4356
              237   905   _____   _____
             1136   78   _____   _____
           _____   _____
           _____   _____

    Multiplication   **Division**

    e.   579   **f.**   68462 ÷ 4
           x   7
           _____   _____
           _____   _____

2. **Calculate the mass weight of 14 lengths of designated 310 UC (universal column), each with a mass of 198 Kg/m x 5.450 m long.**

    Formula   =   (Mass per metre x Length x Quantity)

    Mass   =   Kg/m   x   Length (m) x   Quantity   =   Answer

    Mass   =   _____   =   _____

3. **You are required to calculate the total mass weight of an order of 9 lengths of 200 Parallel Flange Channel (PFC), each with a mass of 22.9 Kg/m and length of 3450 mm**

    Formula   =   QTY   x   Mass weight of material   x   Length (m)

    Mass   =   9   x   22.9Kg/m   x   3.45 m

    Answer (total mass weight in Kg)   =   _____

4. What is the adjacent angle of a right angle triangle when you have a slope ratio of 1:1? (Circle the correct answer)

100

100
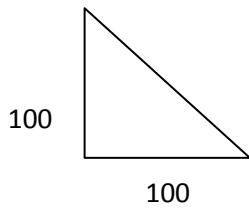
a. $180°$
b. $60°$
c. $30°$
d. $45°$

5. Calculate the average of these numbers: 20, 11, 37, 42, 28

Average   =   _____

6. Using the formula given, calculate a $^1/_{12}$ segment of a pipe where the pipe diameter is 150 mm.

Formula   =   Dia x π   ÷   required segment   where π = 3.1416

Cir/Seg of 1/12th =   150 x 3.1416   ÷   12

Answer   =   _____ mm

7. What would these fractions be if you were to divide them by 2?

a.   ¼   =   _____

b.   ½   =   _____

c.   ⅛   =   _____

d.   ⅜   =   _____

Section 4 - Problem Solving

1. **How many 6 metre lengths of 32 NB (Nominal Bore) diameter pipe will be required to get 88 pieces if each piece is to be 533 mm long?**

_____

2. **A building has 82 columns with each column requiring 68 high tensile bolts. Each bag of bolts contains 40 bolts.**

a.   How many bags will be required?   _____

b.   If no bolts are damaged or lost how many bolts will be left?   _____

3. What is the area of the steel plate which has a size 2.478 metres long and 5.65 metres wide?

    _____

4. Calculate the mass of a plate 2.560 metres x 1.225 metres x 25 mm thick. The mass of a steel plate 1 metre square x 1 mm is 7.85 kg.

    _____

5. Calculate the hole pitch for 28 holes around a 2.4 metres Pitch Circle Diameter (PCD), where π = 3.1416.

    Formula to use: Pitch   =   PCD x π
                                                    Number of holes

    _____

6. What is the volume of a rectangular tank having an inside measurement of 788 mm long 455 mm wide and 256 mm high?

    _____

7. Establish the size of the following X° angles by circling the appropriate answer from the list below .

    a.

                                                    b.

    i.   37.5°   i.   42.5°

    ii.   42.5°   ii.   45°

    iii.   47.5°   iii.   47.5°

    iv.   52.5°   iv.   50°

8. Calculate the volume of this cylinder using the inside diameter measurement. Use π = 3.1416.

Formula = π r² x length = _____

ID Ø 1.78 mm

12.5 mm
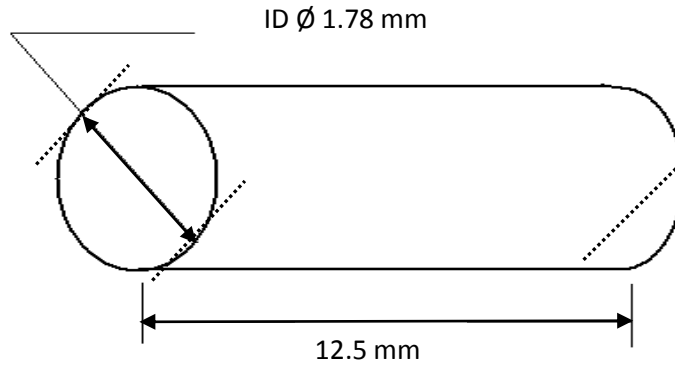
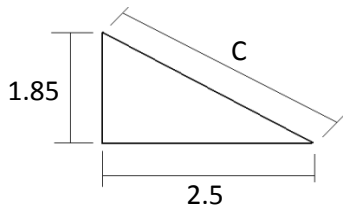9. Calculate the area of this triangle using the following formula:

A = $\frac{Base \times Height}{2}$

A = _____

150 mm

235 mm
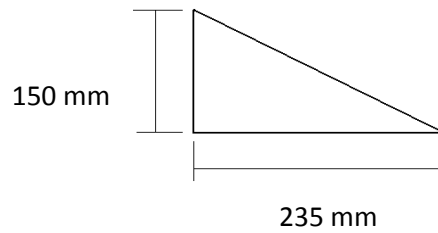
10. What is the diagonal of a triangle having sides measuring A = 2.5 metres x B = 1.85 metres?
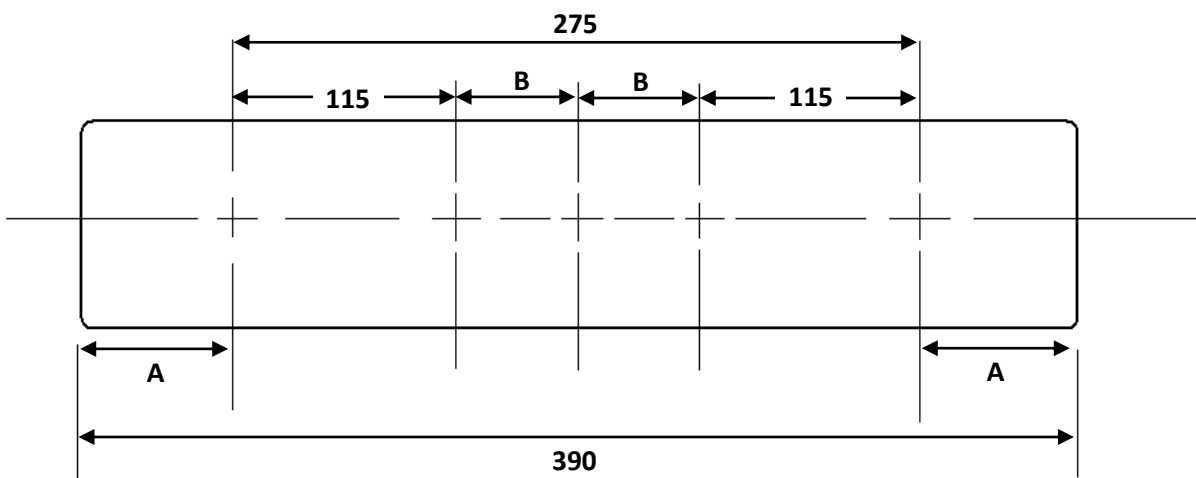
Formula: C = $\sqrt{A^2 + B^2}$
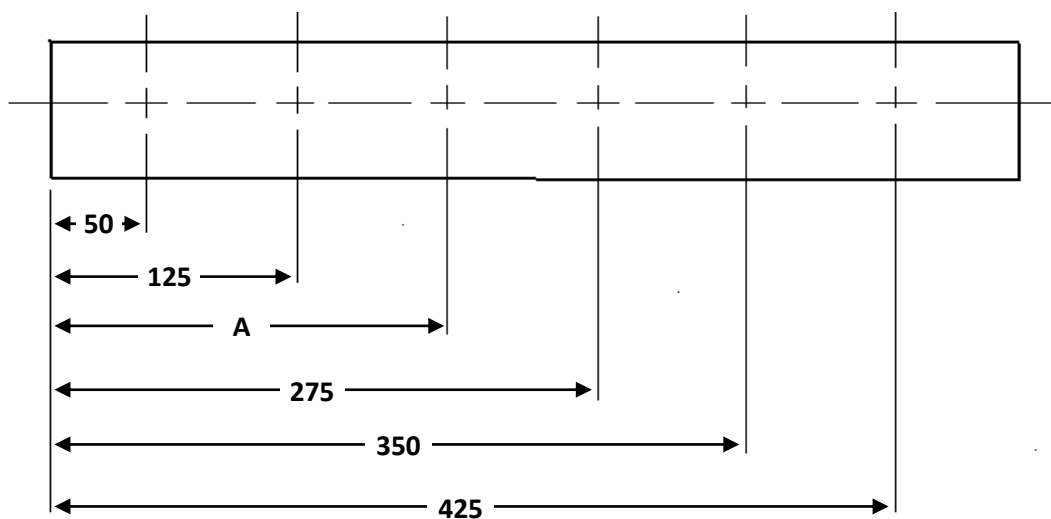
C

1.85

2.5

Answer = _____

11. What are the lengths of segments (A) and (B) in the diagram below? All dimensions are in mm.

A = _____

B = _____

12. Looking at the diagram below, six holes are to be drilled at an equal distance apart. Complete the sequence by determining the dimension of (A). All dimensions are in mm.

Answer = _____

ANSWERS

Section 1 - Literacy, Reading and Comprehension

1. **a.** Addresses   **b.** Doctor
       Welders   Wednesday
       Fixes   January
       Lunches   Millimetres
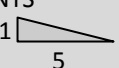   Finishes   Laugh out loud

2.

Actylene
Argon
Carbon dioxide
Helium
Hydrogen
LPG (Liquid Petroleum Gas)
Nitrogen
Oxygen

3.

Paragraph 1	Paragraph 2	Paragraph 3
metal	person	have
some	physical	trade
employer	advancing	skills
for	safely	knowledge
learn	read	such
tradesperson	industrial	interest
through	and	what

4. **a.** ii. Oxygen Acetylene and Oxygen-LPG (liquefied petroleum gas)
     b. iv. Heated Iron and a pure Oxygen jet
     c. iii. Ignition temperature
     d. iv. 815°C

Section 2 - Specific Knowledge

1. **a.** 3 = Base plate - welded to the base of the column member and secured to the footing
     b. 1 = Column - vertical support member of a building frame
     c. 4 = Gussets - plates which connect cross braces to columns
     d. 6 = Stair stringers - side members which support stair treads
     e. 2 = Girder/Beam - the horizontal beam which carries loads and connects column to column
     f. 5 = Landing - the flat area between flights of stairs

2. G = Electric sheet metal sheerer
     A = Electric angle grinder
     C = Electric hand drill (pistol drill)
     B = Straight shank twist drill bit
     D = Hole saw bit
     E = Electric jig saw
     F = Electric sheet metal nibbler

3. **a.** ii. Hack saw   **b.** iv. Self-locking pliers   **c.** iii. Double end ring spanner

4. b. 10.05 mm

5. d. 280

6. a. 4.3 mm tapping drill size

7. **a.** Photo C and Sign C   **b.** Sign B   **c.** Photo A and Photo B   **d.** Sign D

8.
a.	Ø	=	Diameter
b.	PCD	=	Pitch circle diameter
c.	(758)	=	Reference measurement
d.	R	=	Radius
e.	73 ± 0.5	=	Bilateral tolerance
f.	NTS	=	Not to scale
g.	1 ◿ 5	=	Slope ratio and its direction

9.
a.
g	=	50 mm
d	=	250 mm
tw	=	8 mm
r	=	12.0 mm
tf	=	15 mm
bf	=	90 mm

b. Depth of section

Section 3 - Mathematics

1. **a.** 3173   **b.** 1810   **c.** 566   **d.** 8299   **e.** 4053
f. 17115.5

2. 15,107.4K g

3. 711.045 Kg

4. d. 45⁰

5. Average = 27.6

6. 39.27 mm

7.
a. $^1/_4 \div 2 = {}^1/_8$
b. $^1/_2 \div 2 = {}^1/_4$
c. $^1/_8 \div 2 = {}^1/_{16}$
d. $^3/_8 \div 2 = {}^3/_{16}$

Section 4 - Problem Solving

1. 8 lengths of 6 metre 32 Ø NB pipe

2. **a.** 140 bags   **b.** 24 bolts

3. 14 m²

4. 615.44 kg

5. 0.2689 m

6. 91,786,240 mm^3

7. **a.** ii. 42.5° **b.** ii. 45°

8. 31.106 mm³

9. 17625 mm^2

10. C = 3.11 m

11. A = 57.5 mm B = 22.5 mm

12. 200 mm

Contributions

This Practice Aptitude Quiz was developed by:

Australian Apprenticeships Pathways Website - www.aapathways.com.au
This website provides sample Australian Apprenticeships job descriptions and links to more Australian Apprenticeships information and resources. The site is funded by the Department of Industry.

Manufacturing Skills Australia - www.mskills.com.au
Manufacturing Skills Australia (MSA) is one of 12 Industry Skills Councils funded by the Australian Government to support skills development. MSA is addressing the skills needs of over 250,000 manufacturing and other businesses employing over 1.1 million Australians. MSA represents a range of industries including: Metal and Engineering; Manufacturing; Aerospace; Chemicals; Hydrocarbons & Refining; Plastics; Rubber and Cablemaking; Laboratory Operations; Manufactured Mineral Products; Furnishing; and Textiles, Clothing and Footwear.

TAFE NSW Illawarra Institute - www.illawarra.tafensw.edu.au
TAFE NSW is Australia's leading provider of vocational education and training with more than 500,000 enrolments in NSW each year.
Illawarra TAFE provides high quality customised training and enrols over 33,000 students each year. Whether you're an individual looking for your first job, a promotion, a career change or a pathway to a degree or you're an employer seeking training solutions for your workforce, TAFE Illawarra can deliver a range of courses and services to suit your needs. Some programs are delivered Australia wide.

The Career Education Association of Victoria - www.ceav.vic.edu.au
The CEAV is the Victorian peak body for secondary school career practitioners, work experience coordinators, VET coordinators and MIPS coordinators. The CEAV provides professional development opportunities for members and also works with business, industry, and the education and training sector.

Industry Training Australia P/L - www.itaust.com.au
Industry Training Australia (ITA) delivers consultancy services to government and non-government organisations in the education and training sector. ITA develops and delivers information and communication services, including the Australian Apprenticeships Pathways website, for service provider networks and the general public.

For enquiries about this Practice Aptitude Quiz contact the Australian Apprenticeships and Traineeships Information Service on 1800 338 022.