



MATERIALS DESIGN AND TECHNOLOGY

ATAR course examination 2019

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Short answer

15% (27 Marks)

Question 1

(9 marks)

Identify **three** different communication techniques you have used in the design development of a project. Outline how you have used each technique to communicate your design ideas to a client.

Description	Marks
For each of three communication techniques	
Identifies a communication technique	1
Subtotal	3
Outlines how communication technique was used to communicate ideas to a client	2
Makes a general statement about communication technique	1
Subtotal	6
Total	9
<p>Answers could include:</p> <p>Sketching and drawing/rapid concept development/annotated drawings: Concept sketches are hand-drawn quickly using pencils during brainstorming sessions to record initial design ideas. Whether in 2D or 3D, they are very effective when working with a client to ensure understanding of function and aesthetic.</p> <p>Rendering: Adding colour, shading and texture reinforces the design intent and helps visually clarify an idea. Helps to develop the aesthetics further as the final ideas begins to take shape.</p> <p>Modelling/prototyping: The client can sit down with a real version of the product, evaluate and test. It is far easier for the client to have a prototype to hold and manipulate.</p> <p>2D working/technical drawings: Scale technical drawings are used to share important information with the client such as dimensional and material information.</p> <p>3D presentation drawings: 3D presentation drawings such as isometric give a more complete idea of the design, sacrificing some of the technical information. Useful to present an easy to understand visual to the client.</p> <p>Other answers may include:</p> <ul style="list-style-type: none"> • storyboard/inspiration board • specification sheets. <p>Accept other relevant answers.</p>	

Question 2

(12 marks)

- (a) Explain how you considered function in the design of your project. (3 marks)

Description	Marks
Explains how they considered function in the design of a project	3
Describes how they considered function in the design of a project	2
Makes a general statement about how they considered function in the design of a project	1
Total	3
<p>Answers could include:</p> <p>Wood example: The client wanted the project to be light weight so they could lift it easily but also wanted it made from jarrah. Using jarrah would make the project too heavy so instead I included jarrah inlays and features.</p> <p>Textile example: The client indicated they required a winter coat that provided warmth and was fashionable. I designed a high collar to provide shelter from wind and provide protection and warmth. Double breasted button closures were also used to improve the warmth of the jacket.</p> <p>Metal example: The client wanted a modern style coffee table with storage for magazines, television remotes etc. I had to consider the functional aspects of a storage compartment without compromising the desired aesthetic.</p> <p>Accept other relevant answers.</p>	

- (b) Explain how you considered safety in relation to the end user when designing your project. (3 marks)

Description	Marks
Explains how they considered safety in relation to the end user when designing their project	3
Describes how they considered safety in relation to the end user when designing their project	2
Makes a general statement about how they considered safety in relation to the end user when designing their project	1
Total	3
<p>Answers could include:</p> <p>Wood example: When designing the coffee table for my client I was very conscious of the safety of the client and the end users. The project included a glass top and for this I framed the glass in timber so that there was less chance of the glass breaking. I also used tempered glass with bevelled edges, so if the glass did break then it would shatter instead of breaking into shards. All edges on the table were also slightly rounded with sandpaper to remove the sharp edge of the timber.</p> <p>Textile example: There were two ways I considered safety of the end user when designing the product. The first was the length of the dress and ergonomics, to make sure the client could walk safely in the garment without tripping or being restricted in their movements. The dress was also designed using fine, high-quality wool, which is more comfortable and reduces the risk of the client overheating or sweating excessively compared to manufactured fibre.</p> <p>Metal example: The client brief was to design a hall table from metal tubing. I ensured the sizes and proportions of the table were correct so that it would not be unbalanced and potentially fall over causing injury. I also ensured there were no sharp edges on the framework by grinding with an angle grinder. The top, which was made from wood, was sanded smooth to prevent splinters and routed around the edge with a bullnose router bit to remove sharp edges.</p> <p>Accept other relevant answers.</p>	

Question 2 (continued)

- (c) Describe how you addressed **three** environmental issues associated with the manufacture of your project. (6 marks)

Description	Marks
For each of the three environmental issues	
Describes how to address an environmental issue associated with the manufacture of a project	2
Identifies an environmental issue associated with the manufacture of a project	1
Subtotal	2
Total	6
<p>Answers could include:</p> <p>Waste materials:</p> <ul style="list-style-type: none"> • were correctly disposed of • materials that could be reused were stored so that they could be used for another project • scrap material was used for testing, practice etc. • the placement of the patterns on the material to minimise waste. <p>Fumes from air pollution:</p> <ul style="list-style-type: none"> • ensure extraction is on during the process to ensure all harmful toxins are removed from the area • filtration systems are in place to reduce environmental impact. <p>Finish application and disposal:</p> <ul style="list-style-type: none"> • use VAC free finishes • powder coating finish as there is little waste • apply finish in a spray room/booth • leftover finish disposed of appropriately. <p>Waste water:</p> <ul style="list-style-type: none"> • use a bucket of water to cool down welds/metals instead of using running tap water all of the time. <p>Energy usage:</p> <ul style="list-style-type: none"> • ensure that after using each machine they were correctly turned off • ensure that parts match properly by test fitting before joining things together • turn off lights and other power consuming equipment after use. <p>Other answers may include:</p> <ul style="list-style-type: none"> • sourcing sustainable materials • recycling of materials • using local products to lower transport emissions. <p>Accept other relevant answers.</p>	

Question 3

(6 marks)

Outline **three** techniques a designer can use to assess the success of their final product against the design requirements.

Description	Marks
For each of the three techniques	
Outlines a technique a designer can use to assess the success of their final product against the design requirements	2
Makes a general statement about a technique a designer can use to assess the success of their final product	1
Subtotal	2
Total	6
Answers could include: <ul style="list-style-type: none"> • seeking client feedback from the intended market on the final design through the use of a questionnaire, set of criteria etc. • evaluation of final product and how it meets the design brief through self-analysis of design requirements, design influences etc. • through the use of a quality checklist the designer can ensure production methods are to a high standard and that the design has been produced according to the final design • by comparing between the original design and final product the designer can ensure they have met the original intention of the design brief • through the design and use of a performance criteria the designer can use this as an evaluation method of both the design and the final product • checking against design specification sheet. 	
Accept other relevant answers.	

Section Two: Extended answer

25% (37 Marks)

Question 4

(8 marks)

Explore how advances in **two** manufacturing methods have affected purchasing trends in modern society.

Description	Marks
For each of two manufacturing methods	
Explores the relationship between the advance in manufacturing method and purchasing trends in modern society, referring to examples in manufacturing methods	4
Describes the relationship between the advance in manufacturing method and purchasing trends in modern society	3
Outlines the advance in manufacturing method in relationship to purchasing trends in modern society	2
Makes a general statement about the advance in manufacturing method independently from purchasing trends	1
Subtotal	4
Total	8
<p>Manufacturing methods might include:</p> <ul style="list-style-type: none"> • laser cutters • CNC plasma cutters • CNC mills • CNC lathes • seamless technology • automation • 3D printer. <p>Effects on purchasing trends could include:</p> <ul style="list-style-type: none"> • fast and efficient made to order products, more individual choice • quick production of cheaper products, therefore people are buying more • more accuracy in mass produced products (e.g. using laser cutters, faster production, decreased price) • due to the easier, faster and cheaper methods of manufacturing a larger range of products are available resulting in higher turnover of products and an increase in disposal of unfashionable furniture • CNC technology has made it possible to design customised products • flat packed manufacturing methods can be made at low cost, shipped at little expense. This has led to increased purchasing and people being able to fill their houses with furniture at minimal cost. 	
Accept other relevant answers.	

Question 5

(9 marks)

- (a) Identify **two** forms of research the designer could have conducted and describe how each form would have affected the final design. (6 marks)

Description	Marks
For each of two forms of research	
Identifies a form of research the designer could have conducted	1
Subtotal	2
Describes how the form of research would have affected the final design	2
Makes a general statement about how the form of research would have affected the final design	1
Subtotal	4
Total	6
<p>Answers could include:</p> <p>Interviews/client surveys/market research: This ensures that the designer is aware of consumer values and beliefs. It supports the designer producing a product for a particular market and provides confidence that the product will have a market.</p> <p>Research other products on the market: This allows the designer to assess the success and failure of other designs to ensure they are catering to the target market.</p> <p>Social media: Consumer demand and social values can be identified through social media. These identified values can then be considered when designing the product and also used to assess the final design to ensure that the design does not offend and caters to the target market.</p> <p>Other answers may include:</p> <ul style="list-style-type: none"> • materials research • researching anthropometric and ergonomic requirements to improve keepability. <p>Accept other relevant answers.</p>	

- (b) Identify **three** benefits to the designer of undertaking extensive research. (3 marks)

Description	Marks
One mark for each correct answer (maximum of 3 marks)	1–3
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • ensures the success of the design • reduces the risk of designing a product that may offend • reduced risk of design failure • can identify trends in the market • can identify potential design faults/errors • designer can develop a clearer idea of client values • the copyright is upheld. <p>Accept other relevant answers.</p>	

Question 6

(11 marks)

- (a) With reference to the above images, name **two** elements of design and describe how they have worked together to improve the aesthetics of this product. (4 marks)

Description	Marks
For each of two elements of design	
Names an element of design	1
Subtotal	2
For the description	
Describes how the elements work together, referring to overall aesthetics	2
Makes a general statement about the use of elements in the sofa	1
Subtotal	2
Total	4
<p>Answers could include:</p> <p>Elements of design:</p> <ul style="list-style-type: none"> • line • color • texture • shape • form • tone. <p>Sample answers:</p> <p>A curved asymmetrical line has been used along the back of the sofa. It is mirrored along the middle of the backrest by change of tone emphasising the second line. The use of line and tone creates interest in the vast backrest making it more appealing to the viewer.</p> <p>The variety of textures along with the three different colours adds interest and appeal to the product. The texture of light wood, dark fabric and clear perspex all create contrast and increase the aesthetics of the piece.</p> <p>Accept other relevant answers.</p>	

- (b) Explain how the principle of proportion is demonstrated in the design of this product. (3 marks)

Description	Marks
Explains how the principle of proportion is demonstrated in the design of this product	3
Describes how the principle of proportion is demonstrated in the design of this product	2
Makes a general statement about the principle of proportion	1
Total	3
<p>Sample answer:</p> <p>Proportion is used in many ways. The seat back is portioned into two sections using the two tones of colour. The high rise of the seat back is complemented by the table on the other end of the sofa. Finally, one third of the sofa is the table and the remaining two thirds are the seat section, which makes the proportion of the sofa aesthetically pleasing.</p> <p>Accept other relevant answers.</p>	

- (c) Identify how you could change this design to employ repetition and explain how this would improve the aesthetics of this product. (4 marks)

Description	Marks
For the identification	
Identifies how to change the design to employ repetition	1
Subtotal	1
For the explanation	
Explains how the change would improve the aesthetics of this product	3
Describes how the change would improve the aesthetics of this product	2
Makes a general statement about the aesthetics of this product	1
Subtotal	3
Total	4
<p>Sample answer: Repetition could be used in the design in several ways, by repeating shapes, textures or colours throughout the design. The designer could replace the fabric of the sofa with that of similar texture and colour to the wood of the table. The wood could be repeated in the oval clear base. This would create more unity within the design by repeating the textures multiple times, therefore increasing the overall aesthetics of the sofa.</p>	
Accept other relevant answers.	

Question 7

(9 marks)

Consider the potential hazards of the use of a machine in your context. Use the risk level key below to identify **one** high, **one** moderate and **one** low risk that may result from the use of the machine and complete the risk assessment table below.

Description			Marks
One mark for each correct answer (maximum of 9 marks)			1–9
Total			9
Answers could include:			
Wood example: Bandsaw			
Risk assessment table			
Risk level	Hazard	Injury	Controls
High	Sharp rotating blade	Cuts to hands, lacerations	Guards in place, use push sticks, wait for blade to stop before cleaning
Moderate	Entanglement – clothing/hair/jewellery	Body parts pulled into rotating parts. Lacerations, bruising, fractures	Remove loose clothing, jewellery. Tie back long hair, guards in place
Low	Trip/slip	Slip and fall. Bruising, fractures	Keep floor free of obstructions. Place non-slip mats next to machine
Metal example: Lathe			
Risk assessment table			
Risk level	Hazard	Injury	Controls
High	Entanglement – loose clothing, jewellery, long hair	Body parts pulled into rotating chuck. Lacerations, bruising, fractures	Remove loose clothing, jewellery. Tie back long hair
Moderate	Contact with metal chips or swarf	Cuts to hands	Use gloves where necessary when removing swarf
Low	Floor slip hazard	Slip and fall. Bruising, fractures	Keep floor free of obstructions. Place non-slip mats next to machine

Textile example: Overlocker			
Risk assessment table			
Risk level	Hazard	Injury	Controls
High	Lift/falling whilst moving the machine	Back injury, broken toes	Locate machines on appropriate trolley/benches Use correct lifting techniques
Moderate	Entanglement – loose clothing, jewellery, long hair	Lacerations, bruising, fractures	Remove loose clothing, jewellery. Tie back long hair
Low	Posture	Back strain	Sit close to the machine, chair at appropriate height
Accept other relevant answers.			

Section Three: Wood context

60% (69 Marks)

Question 8

(10 marks)

- (a) Identify an innovative timber and list **three** advantages and **three** disadvantages of using this material over solid timber. (7 marks)

Description	Marks
One mark for correctly identifying an innovative timber	1
One mark for each correct advantage (maximum of 3 marks)	1–3
One mark for each correct disadvantage (maximum of 3 marks)	1–3
Total	7
<p>Answers could include: X-Board, melamine, vinyl wrap, plywood, MDF, particle board, engineered wood product, composite and laminate materials.</p> <p>Advantages:</p> <ul style="list-style-type: none"> • available in large sheets • economical • less defects • good dimensional stability • less prone to warping etc. • uses recycled and off-cut materials to produce • flexible and easy to bend over shapes • cost saving and labour costs • lightweight • reduced environmental impacts • pest and insect resistant. <p>Disadvantages:</p> <ul style="list-style-type: none"> • not as aesthetically pleasing • can look cheap • tools can be easily blunted • bowing – thin sheets do not stay flat • joints – less options for joining (i.e. you cannot dovetail etc.) • edges must be treated or covered • long-term UV stability questionable. <p>Accept other relevant answers.</p>	

- (b) With reference to the material identified above, explain the influence this material has had in relation to product design. (3 marks)

Description	Marks
Explains the influence this material has had in relation to product design	3
Describes the influence this material has had in relation to product design	2
Makes a general statement about the influence this material has had in relation to product design	1
Total	3
<p>Answers could include: Vinyl wrap has had huge impacts on how products are designed. Due to the availability in different colours and material treatment, vinyl wrap is used almost exclusively in most housing carpentry and also heavily in furniture construction. This material is cheap and therefore reduces the cost to the consumer when compared to purchasing solid wood furniture. Companies such as IKEA have also revolutionised the use of vinyl wrap through aesthetically appealing design and flat pack furniture.</p> <p>Accept other relevant answers.</p>	

Question 9

(15 marks)

- (a) Using the diagram below, label the parts in the cross-section of the tree. Two have been completed for you. (6 marks)

Description	Marks
One mark for each correct label (maximum of 6 marks)	1–6
Total	6

- (b) Identify **four** differences in cellular structure between softwoods and hardwoods. (4 marks)

Description	Marks
One mark for each correct answer (maximum of 4 marks)	1–4
Total	4

Answers could include:

Hardwoods:

- are made up of vessels, fibres and parenchyma
- vessels are long, cylindrical cells
- fibres are long, thin cells
- they have thick cell walls
- parenchyma surround vessel cells and store food
- fibres are shorter than softwood tracheids.

Softwoods:

- two cell types: tracheids and parenchyma
- large, open cell type
- straight radial rows of cells
- radial rays from the cambium.

Accept other relevant answers.

Question 9 (continued)

- (c) Describe **one** method of seasoning timber. (2 marks)

Description	Marks
Describes one method of seasoning timber	2
Makes a general statement about seasoning timber	1
Total	2
<p>Answers could include:</p> <p>Air seasoning: This is the method where green timber is stacked in the open air until moisture content has reduced to match the environment.</p> <p>Kiln seasoning: Timber is stacked in a building or compartment where the air temperature can be electronically controlled, similar to an oven.</p>	

- (d) List **three** consequences of using timber that has not been seasoned appropriately to the correct moisture content. (3 marks)

Description	Marks
One mark for each correct answer (maximum of 3 marks)	1–3
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • timber could continue to shrink • joints break/separate • timber twists • timber warps • timber could swell • timber could split/crack. <p>Accept other relevant answers.</p>	

Question 10

(18 marks)

- (a) Using the plans on page 8 and the information above, complete the cutting list below and calculate the cost of the materials required to manufacture the dining table. Round the costs to the nearest cent. (7 marks)

Description					Marks
One mark for each part cost (maximum of 7 marks)					1–7
Total					7
Sample answer:					
Part name	Material (mm)	Number required	Total length required (m)	Price per metre	Cost of part(s)
1. Stretcher	200 x 50	1	1.6	\$45.75	\$73.20
2. Leg	90 x 90	4	2.6	\$42.90	\$111.54
3. Short rail	125 x 30	2	1.6	\$15.72	\$25.15
4. Leg base	125 x 50	2	1.6	\$21.34	\$34.14
5. Foot	125 x 30	4	0.4	\$15.72	\$6.29
6. Top	250 x 38	4	8	\$48.88	\$391.04
7. Dowel	20	4	0.92	\$9.05	\$8.33

- (b) Other than materials, identify **three** considerations to be taken into account in costing this product for a client. (3 marks)

Description		Marks
One mark for each correct answer (maximum of 3 marks)		1–3
Total		3
Answers could include <ul style="list-style-type: none"> • electricity • water • consumables – sandpaper, glue, screws, rags etc. • machine maintenance • wage/profit • finish • specialist equipment purchases • wear and tear on tools • client's budget. 		
Accept other relevant answers.		

Question 10 (continued)

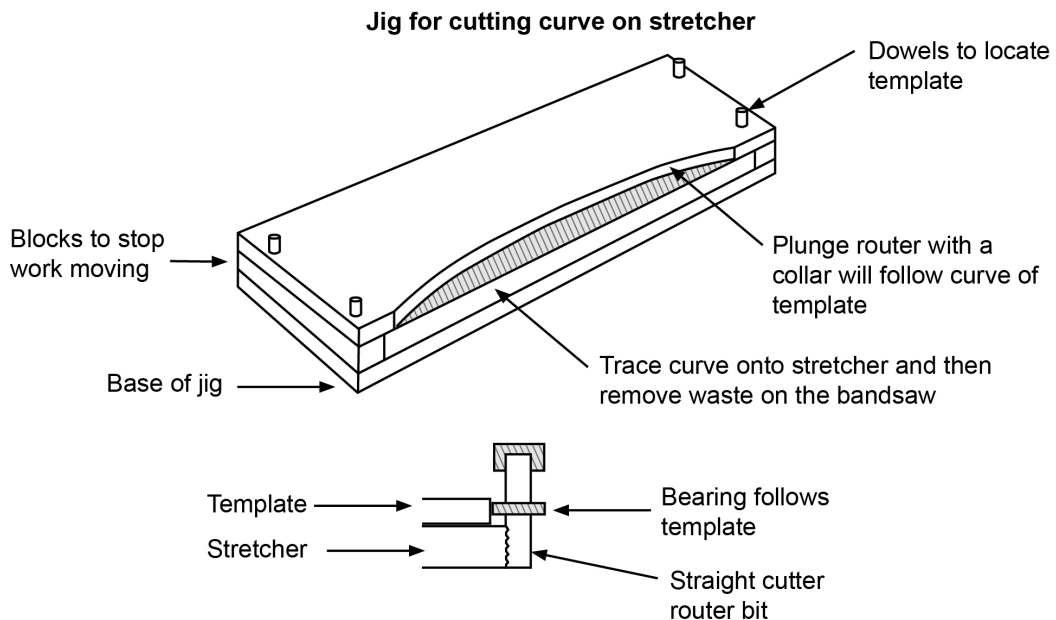
- (c) Identify **two** advantages that the manufacturer would gain by using the jigs and templates. (2 marks)

Description	Marks
One mark for each correct advantage (maximum of 2 marks)	1–2
Total	2
Answers could include: <ul style="list-style-type: none"> • increased accuracy • faster production • less skill required to use the jig • less errors • repeatability • higher quality work. List is not exhaustive.	

- (d) In the space below, sketch and annotate a jig or template that could be used to assist in the manufacture of the dining table. (6 marks)

Description	Marks
For the sketch	
Highly detailed sketch of jig or template	3
Detailed sketch of jig or template	2
Legible sketch of template of jig or template	1
Subtotal	3
For the annotations	
Highly detailed annotations showing design reasoning for a feasible solution	3
Detailed annotations showing design reasoning for a feasible solution	2
Some annotations with little design reasoning for a feasible solution	1
Subtotal	3
Total	6

Sample answer:



Accept other relevant answers.

Question 11

(10 marks)

When routing timber there are many variables to consider and the ability to identify and solve problems is an important skill. In the table below, identify the causes of the possible problems and state the appropriate solutions.

Description		Marks
One mark for each correct cause of each problem (maximum of 5 marks)		1–5
One mark for each correct solution for each problem (maximum of 5 marks)		1–5
Total		10
Answers could include:		
Problem	Cause of problem	Solution
Burning timber	<ul style="list-style-type: none"> • blunt router bit • unseasoned timber • dense timber • speed too fast • moving router too slowly 	<ul style="list-style-type: none"> • sharpen router bit/use quality tooling • select timber with correct moisture content • take smaller cuts • reduce rpm on router • increase feed rate when cutting
Router running along uncontrolled	<ul style="list-style-type: none"> • moving in the same direction as the router bit 	<ul style="list-style-type: none"> • cut against the direction of the cutter
Inconsistent cutting depth	<ul style="list-style-type: none"> • depth stop on router not set • worn parts on router • plunge locking lever not engaged or slipping • warped timber/uneven surface • router bit loose 	<ul style="list-style-type: none"> • set the depth stops before beginning cut • replace worn parts • lock the depth before starting cut • use a router with a smaller base or ensure timber is flat • tighten collar
Wood splintering/tearing	<ul style="list-style-type: none"> • strong grain such as oak • blunt router bit • taking off too much material in one cut • feeding router too fast 	<ul style="list-style-type: none"> • sharpen router bit • use quality bits • make several small cuts • reduce feed rate • ½ inch shank less prone to chatter • cut with the grain • cut end grain first • only small cuts at a time • increase speed a little
Router will not start	<ul style="list-style-type: none"> • electrical issue with the router • not switched on • power supply issue 	<ul style="list-style-type: none"> • have router professionally inspected and fixed • turn switch on • check power point and fuse board
List is not exhaustive.		

Question 12

(6 marks)

(a) Define the term 'niche market'.

(2 marks)

Description	Marks
Defines the term niche market	2
Makes a general statement about niche markets	1
Total	2
Answers could include: Niche market: A niche market is a market that specialises in satisfying specific design needs of a particular market. Accept other relevant answers.	

(b) With reference to the statement above, explore how small-scale local industries have adapted to ensure success in the global market.

(4 marks)

Description	Marks
Explores how small-scale local industries have adapted to ensure success within the global market	4
Describes how small-scale local industries have adapted to ensure success within the global market	3
Outlines how small-scale local industries have adapted to ensure success within the global market	2
Makes a general statement about small-scale local industries	1
Total	4
Answers could include: Explorations may be based on: <ul style="list-style-type: none"> • identifying the target market - consumers' attitudes, needs, wants, spending patterns and lifestyles and also economic factors • offering a unique product or service • personal connection with the customer • customisation to individuals • developing innovative and high-tech products • developing high quality, lasting products • experimenting with new technologies and materials • open to new opportunities and change • looking at where the market has been and where it is going • keeping an eye on current world affairs and events • marketing through social media • website development • use of online stores such as Etsy • selling through internet instead of investing in brick and mortar stores. Accept other relevant answers.	

Question 13

(10 marks)

Considering this statement, outline **five** environmental and **five** social impacts this change in law has had on our local society.

Description	Marks
One mark for outlining each environmental impact (maximum of 5 marks)	1–5
One mark for outlining each social impact (maximum of 5 marks)	1–5
Total	10
<p>Answers could include:</p> <p>Environmental impacts:</p> <ul style="list-style-type: none"> • reduced deforestation • reduction in plant species loss • reduction in animal species loss • less erosion and flooding • less destruction of natural environment • decrease in water pollution • decrease in air pollution • removal of litter • improved habitat for animals • reduced carbon dioxide in the air. <p>Social impacts:</p> <ul style="list-style-type: none"> • shutting down of timber mills • loss of jobs • reduction in export of Jarrah interstate • reduction in export of Jarrah overseas • reduced populations in small towns • reduced income for small towns due to people leaving area • reduced property prices in small towns due to people leaving area • increase in tourism to old growth forests • increase in purchase price of Jarrah due to limited availability • increased reliance on imported timbers • less infrastructure advancements – health care, education, roads. <p>List is not exhaustive.</p>	

Section Three: Metal context

60% (69 Marks)

Question 14

(10 marks)

- (a) Identify a new or emerging metal and list **three** advantages and **three** disadvantages of using this material over traditional materials. (7 marks)

Description	Marks
One mark for correctly identifying a new or emerging metal	1
One mark for each correct advantage (maximum of 3 marks)	1–3
One mark for each correct disadvantage (maximum of 3 marks)	1–3
Total	7
<p>Sample answer:</p> <p>Emerging metal alloys:</p> <ul style="list-style-type: none"> • shape memory alloy (SMA, smart metal, memory metal, memory alloy, muscle wire, smart alloy, nickel-titanium, nitinol) • titanium alloy • copper-aluminium-nickel • copper-zinc-aluminium • iron-manganese-silicon. <p>Shape memory alloy:</p> <p>Advantages:</p> <ul style="list-style-type: none"> • is an alloy that ‘remembers’ its original shape: returning to the pre-deformed shape when heated • lightweight • thermal conductivity • corrosion resistance • nonmagnetic nature • low density • high fatigue strength. <p>Disadvantages:</p> <ul style="list-style-type: none"> • expensive • increased metal fatigue (e.g. bending/twisting over time) • not appropriate for structural use in buildings • long cooling time. <p>Titanium alloy:</p> <p>Advantages:</p> <ul style="list-style-type: none"> • lustrous appearance with a silver colour • low density • high strength • highly resistant to corrosion • non-magnetic • non-toxic. <p>Disadvantages:</p> <ul style="list-style-type: none"> • expensive • hard to machine • non-magnetic • difficult to work with • can cause corrosion in aluminium if adjacent with moisture. <p>List is not exhaustive.</p>	

- (b) With reference to the material identified above, explain the influence this material has had in relation to product design. (3 marks)

Description	Marks
Explains the influence this material has had in relation to product design	3
Describes the influence this material has had in relation to product design	2
Makes a general statement about the influence this material has had in relation to product design	1
Total	3
<p>Answers could include:</p> <p>Titanium alloy: Due to its high strength, low weight and ability to withstand extremes of temperature, titanium has revolutionised the aircraft and aerospace industries. It is also one of the most biocompatible metals, meaning that the human body can handle it in large doses with no impact. This makes it perfect for use in surgical implants, such as hip balls, sockets (joint replacements), heart stents and dental implants.</p> <p>Accept other relevant answers.</p>	

Question 15**(15 marks)**

- (a) On the basis of their properties, provide a reason for the use of each of the **three** different types of steel in the production of the Japanese blade. (3 marks)

Description	Marks
Provides a reason for the use of all three types of steel in the production of the Japanese blade	3
Provides a reason for the use of two types of steel in the production of the Japanese blade	2
Provides a reason for the use of one type of steel in the production of the Japanese blade	1
Total	3
<p>Sample answer:</p> <p>Mild carbon steel is malleable and ductile. This allows the core to be tough and flexible, preventing the blade from breaking.</p> <p>Medium carbon steel has good weldability, high strength and impact resistance. This allows for easier lamination (welding) together of the different types of steel. Also allows for the blade to take the impact of strikes from other blades in combat. Durability (resilience in receiving impacts) prevents blade from bending.</p> <p>High carbon steel has high strength and hardness. The edge of the blade needs to be hard, so it can take a sharper edge to cut more effectively. High carbon steel has enough carbon in it to be hardened via heat treatment.</p> <p>Accept other relevant answers.</p>	

Question 15 (continued)

- (b) The tsuba (hand guard) is made from a non-ferrous alloy. Identify a possible metal from which it could be made. (1 mark)

Description	Marks
One mark for correct answer	1
Total	1
Answers could include: <ul style="list-style-type: none"> • brass • bronze • aluminium alloy • sterling silver. 	

- (c) Identify **three** advantages of using an alloy. (3 marks)

Description	Marks
Identifies one to three advantages of using an alloy (maximum of 3 marks)	1–3
Total	3
Answers could include: <ul style="list-style-type: none"> • low weight • high conductivity • non-magnetic • resistant to corrosion. Accept other relevant answers.	

- (d) Identify **four** differences between the characteristics of ferrous and non-ferrous metals. (4 marks)

Description	Marks
One mark for each correct difference (maximum of 4 marks)	1–4
Total	4
Answers could include: <p>Ferrous metals:</p> <ul style="list-style-type: none"> • used for their tensile strength and durability • high carbon content • prone to rusting • magnetic. <p>Non-ferrous metals:</p> <ul style="list-style-type: none"> • more malleable • lighter • good aesthetic • high resistance to rusting • non-magnetic. Accept other relevant answers.	

(e) The blade was heat-treated to change the properties of the steel. For **two** of the heat treatment methods listed below, state the property change that is involved and how each process could be achieved in the school workshop. Use correct workshop terminology. (4 marks)

- Hardening
- Tempering
- Annealing
- Normalising

Description	Marks
For each of two heat-treatments	
States the property change that is involved	1
States how the process could be achieved in the school workshop	1
Subtotal	2
Total	4
<p>Sample answer:</p> <p>Hardening: Increases the hardness of the metal. Heat metal to cherry red colour using an oxy-acetylene torch or kiln, and quench it quickly in water or oil.</p> <p>Tempering: The purpose of tempering steel is to reduce brittleness by increasing the toughness of the metal with only a slight reduction in the hardness. Tempering involves reheating the steel to a lower temperature and allowing to cool more slowly. The various colours produced indicate the temperature to which the steel was heated.</p> <p>Annealing: Used to remove the hardness of a metal, making it more workable. Heat metal using an oxy-acetylene torch or kiln, and allow to cool slowly.</p> <p>Normalising: Normalising reduces residual stress and brittleness, and reduces the hardness of the material, in order to prepare for the next stage of processing (e.g. improves machinability). It is achieved by heating the steel just above its critical point and air cooling.</p>	
Accept other relevant answers.	

Question 16

(18 marks)

- (a) Using the plans on page 18 and the information above, complete the cutting list below and calculate the cost of the materials required to manufacture the dining table (wood top not included). Round the costs to the nearest cent. (7 marks)

Description					Marks
One mark for each part cost (maximum of 7 marks)					1–7
Total					7
Sample answer:					
Part name	Material (mm)	Number required	Total length required (m)	Price per metre	Cost of part(s)
1. Leg upright	50 x 50 ERW tubing	4	2.86	\$10.85	\$31.03
2. Leg rail	50 x 50 ERW tubing	4	2.40	\$10.85	\$26.04
3. Rectangle vertical	40 x 5 mild steel flatbar	4	1.60	\$4.67	\$7.47
4. Rectangle horizontal	40 x 5 mild steel flatbar	4	0.8	\$4.67	\$3.74
5. Spacer vertical	40 x 5 mild steel flatbar	4	0.44	\$4.67	\$2.05
6. Spacer horizontal	40 x 5 mild steel flatbar	4	0.78	\$4.67	\$3.64
7. Mounting tab	50 x 5 mild steel flatbar	4	0.4	\$5.83	\$2.33

- (b) Other than materials, identify **three** considerations to be taken into account in costing this product for a client. (3 marks)

Description		Marks
One mark for each correct answer (maximum of 3 marks)		1–3
Total		3
Sample answer:		
<ul style="list-style-type: none"> • electricity • welding consumables (e.g. for MIG/ARC/TIG) • gas (e.g. argon) • machine maintenance • grinding discs • finishes and coatings • wage/profit • client's budget. 		
Accept other relevant answers.		

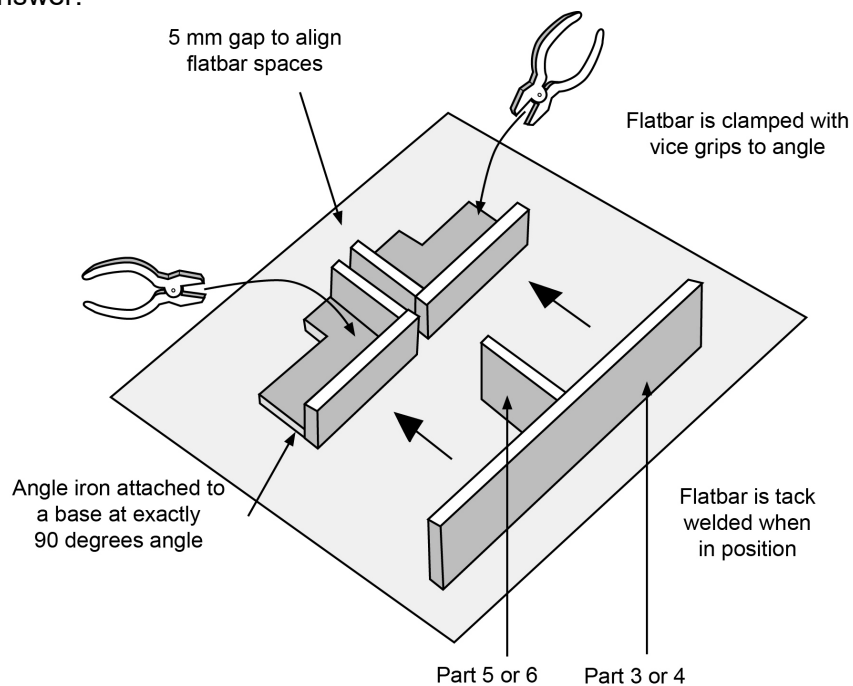
- (c) Identify **two** advantages that the manufacturer would gain by using the jigs and templates. (2 marks)

Description	Marks
One mark for each correct answer (maximum of 2 marks)	1–2
Total	2
Answers could include: <ul style="list-style-type: none"> • increased accuracy • faster production • less skill required to use the jig • less errors • repeatability • higher quality work. List is not exhaustive.	

- (d) In the space below, sketch and annotate a jig or template that could be used to assist in the manufacture of the dining table. (6 marks)

Description	Marks
For the sketch	
Highly detailed sketch of jig or template	3
Detailed sketch of jig or template	2
Legible sketch of template of jig or template	1
Subtotal	3
For the annotations	
Highly detailed annotations showing design reasoning for a feasible solution	3
Detailed annotations showing design reasoning for a feasible solution	2
Some annotations with little design reasoning for a feasible solution	1
Subtotal	3
Total	6

Sample answer:



Accept other relevant answers.

Question 17

(10 marks)

Quality MIG welds are the result of not only good welding technique but also the ability to identify and solve problems if they occur. In the table below, identify the causes of the possible problems and state the appropriate solutions.

Description		Marks
One mark for each correct cause of each problem (maximum of 5 marks)		1–5
One mark for each correct solution for each problem (maximum of 5 marks)		1–5
Total		10
Answers could include:		
Problem	Cause of problem	Solution
No electrical arc (spark) during welding operation	<ul style="list-style-type: none"> welder not turned on an earth has not been established 	<ul style="list-style-type: none"> turn on welder make sure earth clamp is clamped to workbench or workpiece
Porosity of weld (small pinholes)	<ul style="list-style-type: none"> inadequate shielding gas gas bottle not turned on gas bottle empty regulator not at correct pressure gas leaking using wrong type of gas nozzle is too small for type of welding extending the welding wire too far out of the nozzle dirty base metal impurities in the base metal 	<ul style="list-style-type: none"> check gas bottle is turned on set regulator to correct pressure replace gas bottle if empty fix any leaks to hoses, regulators replace gas with correct type replace with a larger nozzle reduce the distance from the nozzle to the workpiece (approximately 10mm) remove rust, grease, paint, coatings, oil, moisture and dirt prior to welding use a different type of metal
Workpiece is distorting (warping) after welding	<ul style="list-style-type: none"> too much heat 	<ul style="list-style-type: none"> select a lower voltage range reduce the wire feed speed increase your travel speed do not overweld use intermittent welds (stitch welding) use clamps or jigs to lock workpiece in position

<p>Lack of penetration – shallow fusion between weld metal and workpiece</p>	<ul style="list-style-type: none"> • insufficient heat • insufficient voltage 	<ul style="list-style-type: none"> • select higher wire feed speed • select higher voltage range • reduce travel speed • prepare joint correctly
<p>Electrode (wire) is not coming out of handpiece</p>	<ul style="list-style-type: none"> • wire is tangled in wire feed unit (birdnesting) • weld forms at contact tip (burnback) • kinked or blocked liner • ran out of wire 	<ul style="list-style-type: none"> • trim the affected wire and re-thread it through the feeder and back to the handpiece • replace tip • decrease roll tension • increase wire feed speed • do not hold handpiece too close to the workpiece • replace tip by removing nozzle and tip, snipping the wire, installing the new contact tip and replacing the nozzle • replace liner with correct size for wire

List is not exhaustive.

Question 18

(6 marks)

(a) Define the term 'niche market'.

(2 marks)

Description	Marks
Defines the term niche market	2
Makes a general statement about niche markets	1
Total	2
Answers could include: Niche market: A niche market is a market that specialises in satisfying specific design needs of a particular market. Accept other relevant answers.	

(b) With reference to the statement above, explore how small-scale local industries have adapted to ensure success in the global market.

(4 marks)

Description	Marks
Explores how small-scale local industries have adapted to ensure success within the global market	4
Describes how small-scale local industries have adapted to ensure success within the global market	3
Outlines how small-scale local industries have adapted to ensure success within the global market	2
Makes a general statement about small-scale local industries	1
Total	4
Answers could include: Explorations may be based on: <ul style="list-style-type: none"> • identifying the target market – consumers' attitudes, needs, wants, spending patterns and lifestyles and also economic factors • offering a unique product or service • personal connection with the customer • customisation to individuals • developing innovative and high-tech products • developing high quality, lasting products • experimenting with new technologies and materials • open to new opportunities and change • looking at where the market has been and where it is going • keeping an eye on current world affairs and events • marketing through social media • website development • use of online stores such as Etsy • selling through internet instead of investing in brick and mortar stores. Accept other relevant answers.	

Question 19

(10 marks)

Considering this statement, outline **five** environmental and **five** social impacts of iron ore production on the local mining industry and community.

Description	Marks
One mark for outlining each environmental impact (maximum of 5 marks)	1–5
One mark for outlining each social impact (maximum of 5 marks)	1–5
Total	10
<p>Answers could include:</p> <p>Environmental impacts:</p> <p>Ore extraction:</p> <ul style="list-style-type: none"> • effect on water runoff • native forest clearing • destruction of native animal habitats and flora • increased atmospheric pollution and dust • loss of public access to forests • damage to top soil • release of metals and chemicals into nearby streams, freshwater bodies and the atmosphere. <p>Production:</p> <ul style="list-style-type: none"> • high greenhouse gas emissions • high energy demand. <p>Social impacts:</p> <p>Land:</p> <ul style="list-style-type: none"> • damage to archaeological sites • indigenous communities may lose access to tribal land and gain little financially. <p>Employment:</p> <ul style="list-style-type: none"> • more opportunities • bring jobs and training for local and indigenous people • increase local business activity. <p>Facilities:</p> <ul style="list-style-type: none"> • more infrastructure – health care, education, roads • help create new communities. <p>Economy:</p> <ul style="list-style-type: none"> • positive – economic uplift, brings wealth to regional areas • negative – increased cost of living, particularly in area of housing, for the local community • increase problem with alcohol and drug abuse • lifespan of such operations is often finite resulting in local communities struggling to sustain employment and social conditions once the project is completed. <p>List is not exhaustive.</p>	

Section Three: Textiles context

60% (69 Marks)

Question 20

(10 marks)

- (a) Identify a knit fabric and list **three** advantages and **three** disadvantages of using this material over a woven fabric. (7 marks)

Description	Marks
One mark for correctly identifying a knitted fabric	1
One mark for each correct advantage (maximum of 3 marks)	1–3
One mark for each correct disadvantage (maximum of 3 marks)	1–3
Total	7
<p>Answers could include:</p> <p>Weft knit (jersey, single, double, pile):</p> <p>Advantages:</p> <ul style="list-style-type: none"> • stretches along the width • they have a right and a wrong side • creates ease in a garment • provided garment with more movement and increased ergonomics. <p>Disadvantages:</p> <ul style="list-style-type: none"> • will unravel like woven fabric • will curl when cut • may stretch over time or shrink lengthwise • less structure in your construction. <p>Warp knit (tricot, raschel, lace, net):</p> <p>Advantages:</p> <ul style="list-style-type: none"> • will not unravel • looks similar on both sides • has a two way stretch • more variety on interlocking stitches. <p>Disadvantages:</p> <ul style="list-style-type: none"> • often see-through • has a two way stretch • less dimensional stability • weaker. <p>Accept other relevant answers.</p>	

- (b) With reference to the knit fabric identified above, explain the influence this material has had in relation to product design. (3 marks)

Description	Marks
Explains the influence this material has had in relation to product design	3
Describes the influence this material has had in relation to product design	2
Makes a general statement about the influence this material has had in relation to product design	1
Total	3
<p>Answers could include:</p> <p>Warp knit is constructed by having the yarn run lengthwise across the fabric. It has allowed garments to be knitted into a circular fabric such as seamless t-shirts, hosiery or be knitted into flat fabric, giving a large variety of design options. Along with computer aided design, warp knits can be knit into three dimensional shapes, allowing designers more versatility in figure forming designs.</p> <p>Accept other relevant answers.</p>	

Question 21

(15 marks)

- (a) Referring to a fibre, describe how its longitudinal shape affects its properties. (2 marks)

Description	Marks
Describes how the longitudinal shape of the fibre affects its properties	2
States the longitudinal shape	1
Total	2
<p>Sample answers:</p> <p>Wool has a scale-like appearance which all go in the same direction. These scales mean that the fibre has low to moderate abrasion resistance but gives excellent elasticity. Wool has excellent felting abilities as the scales rub in different directions.</p> <p>Cotton's irregular twists, called convolutions, makes it difficult for light to reflect, therefore cotton is not lustrous. It is easily spun into fine yarn, making cotton versatile in its dyeing capabilities.</p> <p>Accept other relevant answers.</p>	

- (b) List
- three**
- predominantly crystalline fibres. (3 marks)

Description	Marks
One mark for each correct fibre (maximum of three marks)	1–3
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • polyester • cotton • silk • nylon. <p>Accept other relevant answers.</p>	

- (c) With reference to their properties, distinguish the differences between the polymer structures of amorphous and crystalline fibres. (4 marks)

Description	Marks
Detailed referencing to properties when distinguishing differences between the polymer structures of amorphous and crystalline fibres	4
Reference to some properties when distinguishing differences between the polymer structures of amorphous and crystalline fibres	3
Differences identified between the polymer structures of amorphous and crystalline fibres	2
Limited differences identified between the polymer structures of amorphous and crystalline fibres	1
Total	4
<p>Sample answer:</p> <p>Polymers are multiple fibre units that joined together. The space between these polymers is the polymerisation of the fibre. Crystalline fibres have very little space between polymers and are in parallel arrangement. Amorphous fibres have the polymers further apart and are arranged randomly. As the polymers are further apart amorphous fibres are weaker, but this also makes them more absorbent. Crystalline fibres being closer together are stronger and have more durability.</p> <p>Markers note: A diagram may be used as the basis for an answer.</p> <p>Accept other relevant answers.</p>	

Question 21 (continued)

(d) Identify **three** advantages of using a fibre blend. (3 marks)

Description	Marks
Identifies one to three advantages of using a fibre blend (maximum of 3 marks)	1–3
Total	3
Answers could include: <ul style="list-style-type: none"> • increases performance of the yarn • increases dye capabilities • makes it stronger • allows the yarn to stretch • reduces production costs/material costs. Accept other relevant answers.	

(e) Select a type of yarn and outline why a designer would choose that yarn. (3 marks)

Description	Marks
One mark for correct yarn selection	1
Outlines why the yarn is appropriate for the end use	2
Lists yarn characterises	1
Total	3
Answers could include: Spun staple yarn: <ul style="list-style-type: none"> • good absorbency resiliency and elasticity suitable for quilts and short-term clothing such as t-shirts. Filament yarn: <ul style="list-style-type: none"> • strong, good lustre and durability. Underwear, hosiery, pyjamas/boxers shorts, evening wear, costumes. Extremely versatile when knitted. Accept other relevant answers.	

Question 22

(18 marks)

- (a) Using the pattern on page 28 and the information above, complete the materials list below and calculate the cost of the materials required to produce the skirt. Round the costs to the nearest cent. (7 marks)

Description			Marks
One mark for each part cost (maximum of 7 marks)			1–7
Total			7
Sample answer:			
Item	Quantity	Price per metre	Cost
Cotton plain weave	0.09 m	\$4.95	\$0.45
Cotton sateen weave	1.24 m	\$14.95	\$18.54
Interfacing	0.09 m	\$9.99	\$0.90
Lining	1.24 m	\$4.99	\$6.19
Zipper	1		\$1.99
Hooks and eyes	1		\$3.50
Lace trim	0.74 m	\$7.50	\$5.55

- (b) Other than materials, identify **three** considerations to be taken into account in costing this product for a client. (3 marks)

Description	Marks
One mark for each correct answer (maximum of 3 marks)	1–3
Total	3
Answer could include <ul style="list-style-type: none"> • electricity • water • notions, buttons, elastic • thread • machine needles • equipment and tools (e.g. tape measure and scissors) • machine maintenance • labour/wage/profit • specialist equipment purchases • client's budget. 	
Accept other relevant answers.	

Question 22 (continued)

- (c) Identify **two** processes or items of equipment that a manufacturer could use to improve accuracy when marking or cutting out a pattern. (2 marks)

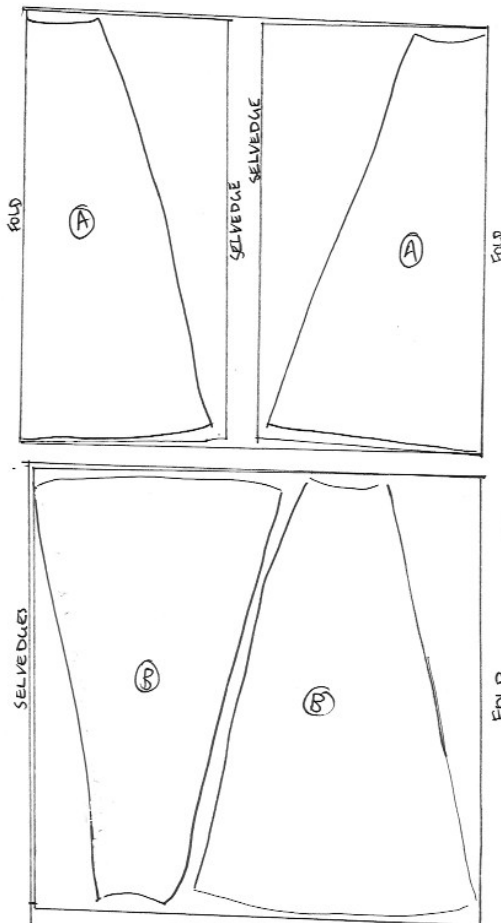
Description	Marks
One mark for each correct answer (maximum of 2 marks)	1–2
Total	2
Answer could include: <ul style="list-style-type: none"> • chalk markings, tailors wheel • tracing or tacking a pattern • ironing the fabric • pinning or securing the pattern using weights • rotary cutter • prewash/shrink the fabric • CAM • laser cutter. 	
List is not exhaustive	

- (d) In the space below, sketch and annotate a pattern layout the manufacturer could use to minimise waste when cutting out the lining pattern pieces A and B. (6 marks)

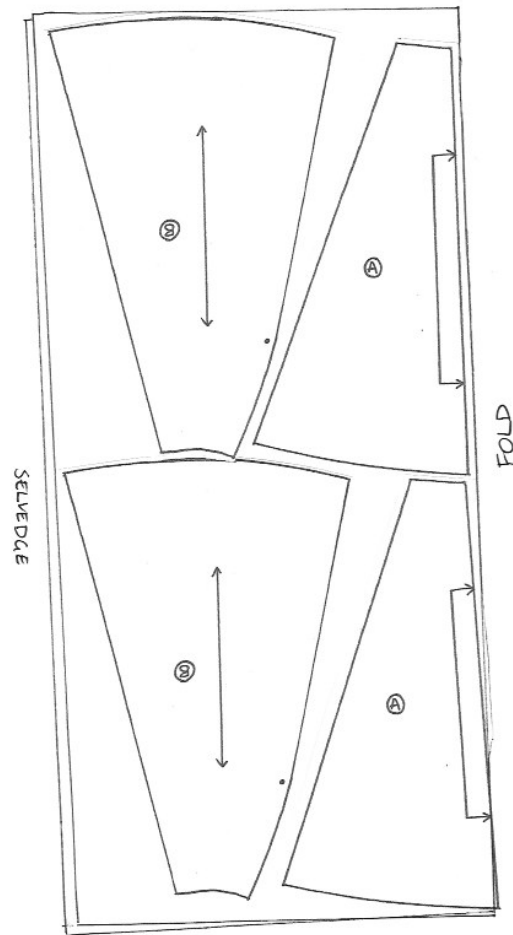
Description	Marks
For the sketch	
Detailed pattern layout that appropriately minimises waste and follows correct grainlines and pattern instructions	3
Pattern layout appropriately minimises waste or follows correct grainlines	2
Pattern layout follows correct grainlines	1
Subtotal	3
For the annotations	
Highly detailed annotations demonstrating reasoning for the drawn pattern layout to fulfil the requirement of reducing waste	3
Detailed annotations demonstrating reasoning for the pattern layout to fulfil the feasible solutions	2
Labels pattern layout	1
Subtotal	3
Total	6

Possible solutions include:

Solution 1



Solution 2



Accept other relevant answers.

Question 23

(10 marks)

Quality overlocking is the result of not only good technique, but also the ability to identify and solve problems if they occur. In the table below, identify the causes of the possible problems and state the appropriate solutions.

Description		Marks
One mark for each correct cause of each problem (maximum of 5 marks)		1–5
One mark for each correct solution for each problem (maximum of 5 marks)		1–5
Total		10
Answers could include:		
Problem	Cause of problem	Solution
Fabric rolling under	<ul style="list-style-type: none"> • cutter not adjusted properly to edge • roll edge setting engaged • cutter not engaged 	<ul style="list-style-type: none"> • tighter cutter • change/check knife settings • raise cutter
Loose looper threads	<ul style="list-style-type: none"> • tension incorrect/too loose 	<ul style="list-style-type: none"> • change the upper looper tension down • check the differential feed
Thread not on the edge of the material	<ul style="list-style-type: none"> • machinist error • loose upper looper 	<ul style="list-style-type: none"> • work with the curve of the fabric, stretch fabric along the bias
Stitching gathering	<ul style="list-style-type: none"> • stitch tension too tight 	<ul style="list-style-type: none"> • check stitch length and thread tension
Fabric cutting caught in stitching	<ul style="list-style-type: none"> • cutter blunt 	<ul style="list-style-type: none"> • sharpen cutter/service machine
List is not exhaustive.		

Question 24

(6 marks)

(a) Define the term 'niche market'.

(2 marks)

Description	Marks
Defines the term niche market	2
Makes a general statement about niche markets	1
Total	2
Answers could include: Niche market: A niche market is a market that specialises in satisfying specific design needs of a particular market. Accept other relevant answers.	

(b) With reference to the statement above, explore how small-scale local industries have adapted to ensure success in the global market.

(4 marks)

Description	Marks
Explores how small-scale local industries have adapted to ensure success within the global market	4
Describes how small-scale local industries have adapted to ensure success within the global market	3
Outlines how small-scale local industries have adapted to ensure success within the global market	2
Makes a general statement about small-scale local industries	1
Total	4
Answers could include: Explorations may be based on: <ul style="list-style-type: none"> • identifying the target market - consumers' attitudes, needs, wants, spending patterns and lifestyles and also economic factors • offering a unique product or service • personal connection with the customer • customisation to individuals • developing innovative and high-tech products • developing high quality, lasting products • experimenting with new technologies and materials • open to new opportunities and change • looking at where the market has been and where it is going • keeping an eye on current world affairs and events • marketing through social media • website development • use of online stores such as Etsy • selling through internet instead of investing in brick and mortar stores. Accept other relevant answers.	

Question 25

(10 marks)

Considering this statement, outline **five** environmental and **five** social impacts of textile production on the local industry and community.

Description	Marks
One mark for outlining each environmental impact (maximum of 5 marks)	1–5
One mark for outlining each social impact (maximum of 5 marks)	1–5
Total	10
<p>Answers could include:</p> <p>Environmental impacts:</p> <ul style="list-style-type: none"> • increase of agricultural land use in Australia • loss of natural environment • increase in erosion • decrease in water pollution as processing is offshore • decrease in air pollution as processing is offshore • increased use of water on farms • increased use of lime treatments to soils • transport of product overseas and then back. <p>Social impacts:</p> <ul style="list-style-type: none"> • increase in local jobs (e.g. shearers, farmers) • more jobs in research and development to improve quality of wool and cotton • increase cost in the price of textiles due to high demand • loss of processing jobs and skills in Australia • communities are revitalised due to the increase in the sale price. <p>List is not exhaustive.</p>	

ACKNOWLEDGEMENTS

- Question 9(a)** Purdue University. (n.d.). Tree cross section [Diagram]. Retrieved October, 2019 from https://extension.entm.purdue.edu/EAB/images/tree_cross_section_lg.gif
- Question 10(d)** Diagram of jig for cutting curve on stretcher provided by courtesy of a member of the examining panel
- Question 16(d)** Diagram of metal jig provided by courtesy of a member of the examining panel
- Question 22(d)** Diagram of pattern layout template provided by courtesy of a member of the examining panel

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