On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

**Criterion 2**  
Apply geometric knowledge and skills in interpreting and transferring drawings.

**Criterion 3**  
Solve geometric problems.
CANDIDATE INSTRUCTIONS

You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criteria being assessed.

You must answer **SIX** questions in total (on the drawing paper provided):

- **ALL FOUR** questions from Section A
- **ONE** question from each of Sections B and C

You should spend approximately 60 minutes on Section A and approximately 30 minutes on each of the other two questions.

You are required to use correct linework and presentation, and are encouraged to include freehand sketches, where necessary, to show the development of ideas in the solution of problems. Construction must be shown.

All dimensions are in millimetres unless otherwise stated.

All written responses must be in English.
Answer **ALL** questions in this section on the drawing paper provided.

**Question 1** – This question assesses **Criterion 3**.

Three spiders on a rooftop at location A detect a fly at location D in Figure 1. Spider X decides to move from A to C to D to catch the fly. Spider Y decides to move straight from A to D. Spider Z decides that A to E to D is the best route.

If all spiders travel at the same speed, determine graphically who gets the meal.

![Figure 1](image-url)
Section A (continued)

**Question 2** – This question assesses **Criterion 2**.

A rotating table and spindle assembly has a metal ball attached to the spindle by a string as shown in the plan view in Figure 2.

If the assembly was suddenly stopped from rotating, draw the path that the ball would follow until it contacted the spindle.

![Figure 2](image)

**Figure 2**

Section A continues.
Section A (continued)

**Question 3** – This question assesses **Criteria 2 and 3**.

Figure 3 shows the plan view of a force diagram with three guy wires holding a TV antenna (P) on a flat roof.

Plot a force diagram showing a fourth guy wire that will hold the antenna in a stable position.

Show graphically the magnitude (force) and direction of the fourth guy wire.

![Force Diagram with four guy wires](image)

**Figure 3**

**Question 4** – This question assesses **Criteria 2 and 3**.

An archer aims at a target and fires an arrow, which flies across level ground in a parabolic path to the target’s centre.

The arrow is fired from a height of 1.5 metres above the ground and is 10 metres above the ground at its highest point during flight. The target centre is also 1.5 metres above the ground and the target is inclined at 45˚ to the ground. The target centre is 30 metres from the archer.

Choose a suitable scale and:

(a) construct the parabolic path of the arrow.

(b) show the true angle that the arrow makes with the target.
SECTION B

Answer ONE question from this section on the drawing paper provided.

This section assesses Criteria 2 and 3 weighted 1:4 respectively.

Question 5

A transition piece on a roof for a sheet metal duct is shown in Figure 4.

Construct a half development of the transition piece commencing from join AB.

Figure 4
Section B (continued)

Question 6

An elliptical cam operates a mechanism as shown in Figure 5. Plot a Follower Displacement Diagram (FDD) for the inline knife-edged follower E and show the locus of point P for one revolution of the cam.

Cam major axis AB = 60
Cam minor axis CD = 32
Shaft Diameter = 6
FP slides through fixed point G.

Figure 5
Section B (continued)

Question 7

An isometric view of a shaped solid is shown below in Figure 6.

(a) Draw the elevation of the solid when looking from the direction of arrow A.

(b) Project a plan view in 3\textsuperscript{rd} Angle Projection from the elevation.

(c) Project an auxiliary elevation of the solid that will show the true shape of surface B.
Answer ONE question from this section.

This section assesses Criteria 2 and 3 weighted 4:1 respectively.

---

**Question 8**

Figure 7 shows the plan and elevation of two truncated triangular based prisms that are interpenetrating.

Re-draw the plan and elevation at a scale of 1:1, and then project an end elevation from those views. Show all lines of interpenetration in all views.

---

**Figure 7**

Section C continues.
Section C (continued)

Question 9

Figure 8 shows a circle R and a semicircle S, which are in contact with the line AB. Also shown are two points P and Q on the circumference of the circle and semicircle respectively.

(a) The circle R rolls clockwise along AB until P contacts AB. Plot the locus of P for this movement.

(b) The semicircle S rolls anticlockwise along AB until Q contacts AB. Plot the locus of Q for this movement.

Figure 8
Section C (continued)

Question 10

A metal alloy has been developed which expands significantly when heated and contracts significantly when cooled.

The metal is produced in the form of a rod with a regular pentagonal cross-section. At 0°C the rod cross-section has a perimeter of 100 mm.

Choose a suitable scale and

(a) Construct the pentagonal cross-section when the rod has been heated to 200°C and expands in area to the ratio 6:5.

(b) Construct the pentagonal cross-section when the rod has been cooled to –100°C and contracts in area to the ratio 7:8.

(c) Construct the cross-section at 0°C and convert it to a triangle of the same area.