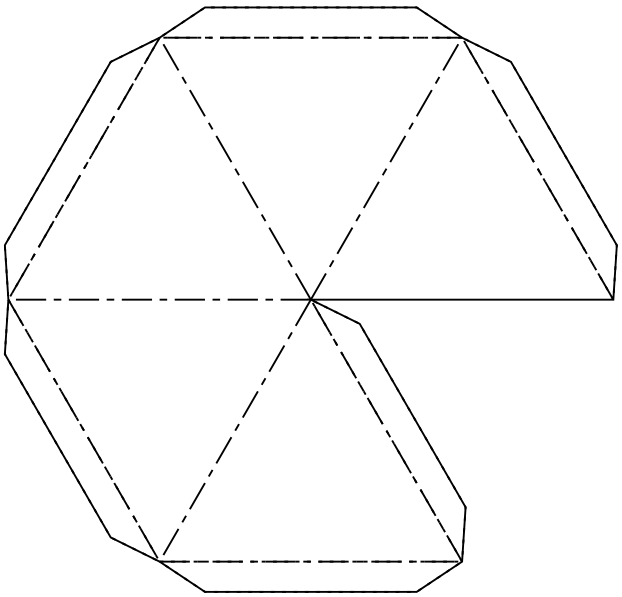
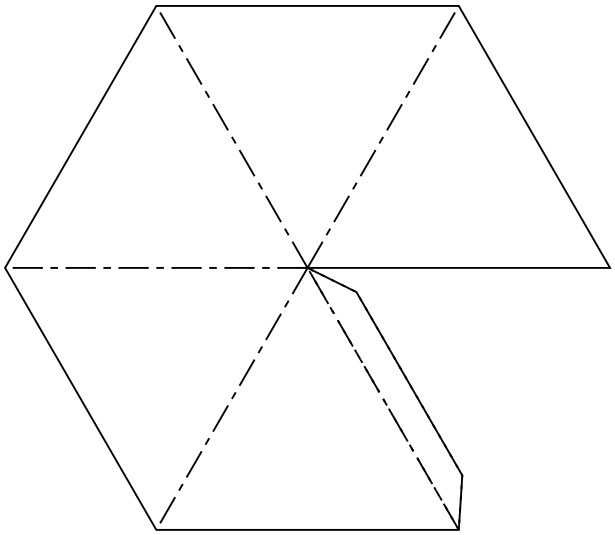
Equal-edge Pentagonal Bipyramid

pentagonal-bipyramid / 1.0.0 / A4 / Template page 1

U | cut 1
80.93 x 77.28 mm



L | cut 1
80.00 x 69.28 mm



Solid: cut | Dashed: valley | Dash-dot: mountain | Dotted: glue

50 mm calibration

Print at 100% / Actual size. Do not fit to page. Original paper craft template.

Equal-edge Pentagonal Bipyramid

pentagonal-bipyramid / 1.0.0 / A4 / Assembly instructions

Finished size: 61.554 x 64.721 x 42.058 mm; all 15 edges 40 mm

Materials: 160-180 gsm paper; Scissors; Blunt scoring tool; Ruler; Protractor; PVA glue; Tweezers; Pencil

Original construction. Physical printing, cutting and assembly deferred.

10 equilateral faces, 15 edges, 7 vertices; two connected cut pieces. Every face has three 40 mm edges and three 60 degree corners; triangle altitude 34.641016 mm.

Exact construction: equator circumradius = 40/(2 sin(36 degrees)) = 34.026032 mm; half height = sqrt(40^2-radius^2) = 21.029244 mm. The two apices are directly above and below the pentagon centre.

Radial mountain turn from flat: 41.810315 degrees; interior dihedral 138.189685 degrees. Equator tab mountain turn: 105.245264 degrees; interior dihedral 74.754736 degrees. Angles are computed from outward face normals, not fitted by stretching.

Seam numbering key: view each cut fan printed side up, with its missing 60-degree wedge at lower right and one free radius pointing right. O is the common triangular apex. Number faces U1-U5 or L1-L5 counterclockwise from the right-pointing radius. Transfer these face names and the following seam numbers to the inside in pencil before folding.

Seam 1: U5 terminal-radius tab to U1 initial free radius. Seam 2: L5 terminal-radius tab to L1 initial free radius. Equator seams: 3 = U1 tab to L5; 4 = U2 tab to L4; 5 = U3 tab to L3; 6 = U4 tab to L2; 7 = U5 tab to L1. Label BOTH sides of each correspondence.

Printed side faces outside. All marked folds are mountain folds away from that side. Apply glue to the printed side of the tabs and tuck beneath receiving panels. Each tab is 4 mm deep, tapering by 6 mm at each end; tip length 28 mm.

Zero paper/glue thickness is idealized. Every tab is included in flat and assembled geometry; no hidden cap, extra strip, stretched face or unlisted cut. Coincident tab/receiver surfaces are intentional.

Part inventory (cut each instance once):

U: U: five-face fan

L: L: five-face fan

1. Print, label and cut two fans [U, L]: Print at actual size (100 percent). Measure the 50 mm ruler and a 40 mm triangle edge. Using the numbering key, pencil U1-U5, L1-L5 and both ends of seams 1-7 on the inside. Cut the outer outlines of U and L, retaining all seven tabs. Do not cut radial hinges.

2. Score exact folds [U, L]: Score four internal radial hinges per fan and seven tab roots. With print outside, mountain-fold radial hinges and seam 1/2 tabs by 41.810315 degrees from flat (138.189685 degrees inside). Fold equator tabs 3-7 by 105.245264 degrees from flat (74.754736 degrees inside). Keep all triangles planar.

3. Close upper fan at seam 1 [U]: Bring U5 terminal radius to U1 initial radius, matching O and the two rim endpoints. Glue the 4 mm seam 1 tab beneath U1. Press through the open pentagonal rim until tacky; let set. The rim sides are 40 mm and the apex is 21.029 mm above the rim plane.

4. Close lower fan at seam 2 [L]: Glue the L5 terminal-radius tab beneath L1 at seam 2, matching the full 40 mm edge. Press through the open rim and let set. Keep the five un-tabbed rim edges straight.

5. Align the pentagonal rims [U, L]: Dry-fit with apices pointing opposite ways and both rims coincident. Match 3: U1-L5, 4: U2-L4, 5: U3-L3, 6: U4-L2, 7: U5-L1. All five U tabs tuck inside L. Match endpoints rather than forcing panels to bow.

6. Glue seams 3 through 6 [U, L]: Apply a thin glue film to the printed side of tab 3 and mate it under L5. Then glue 4, 5 and 6 in order, pressing each 4 mm overlap with tweezers through the remaining seam 7 opening. Let these seams set before final closure.

7. Close seam 7 and dry [U, L]: Put a little glue on tab 7 through the last opening, tuck it beneath L1, and gently press L1 onto it from outside until tacky. Do not crush the hollow shell. Allow full drying; finished tip-to-tip height is 42.058 mm. Physical assembly remains deferred until a real print-and-build trial.