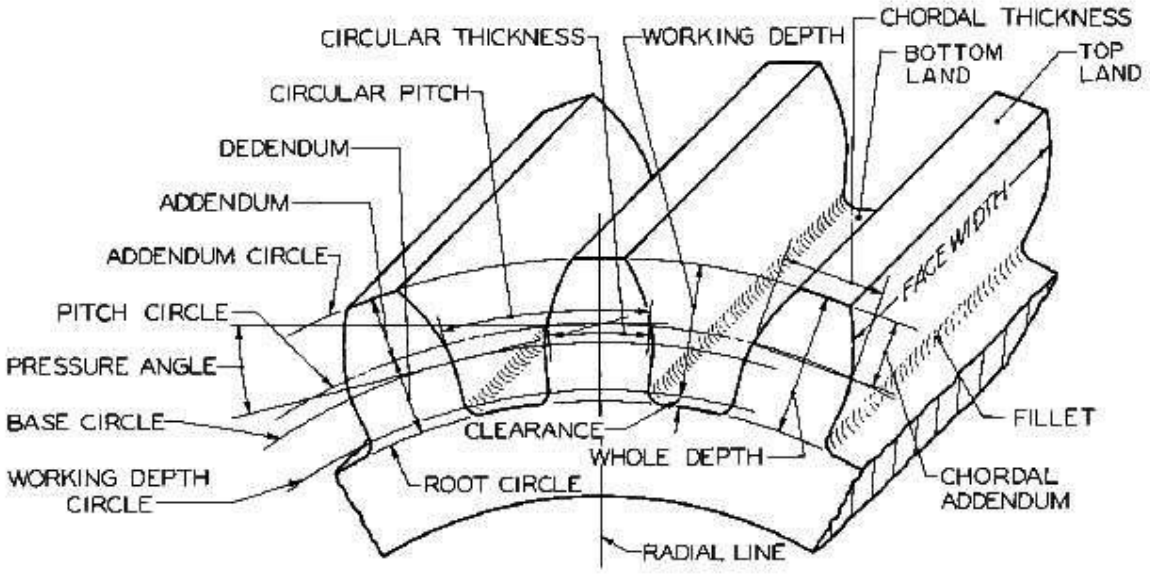
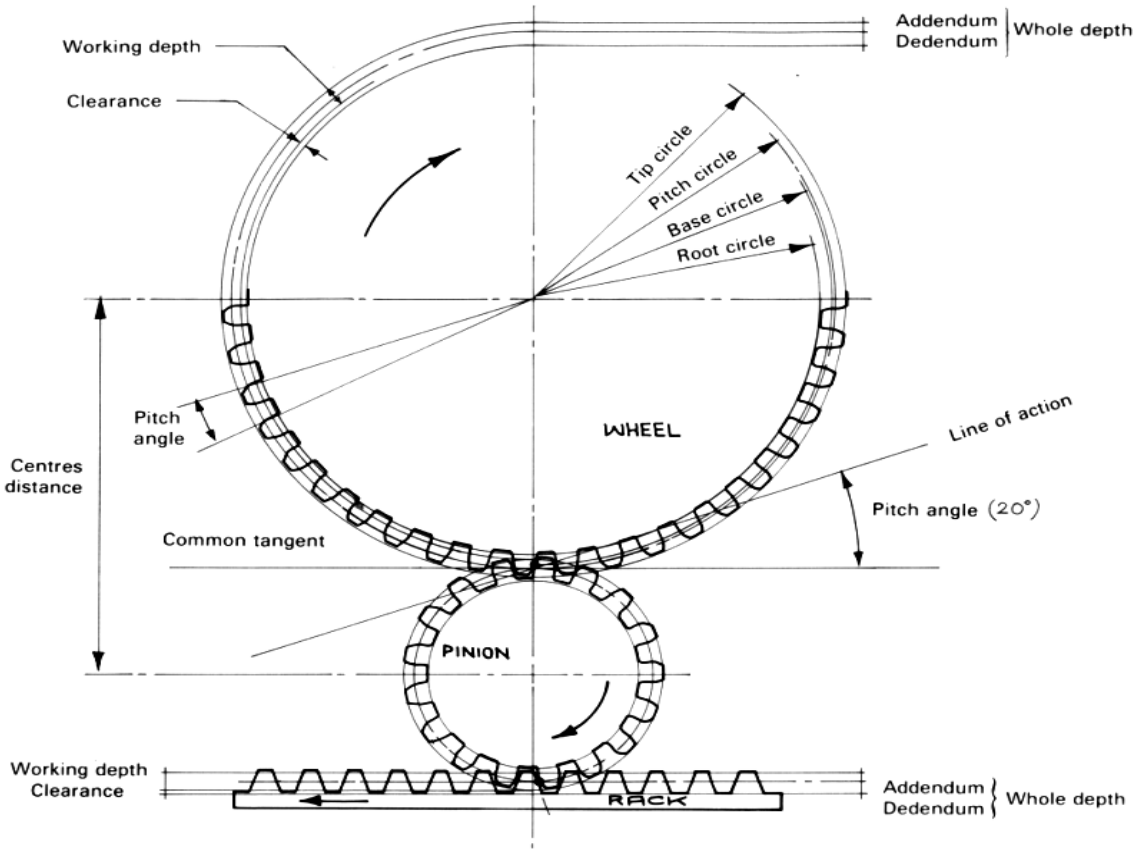
Gears:

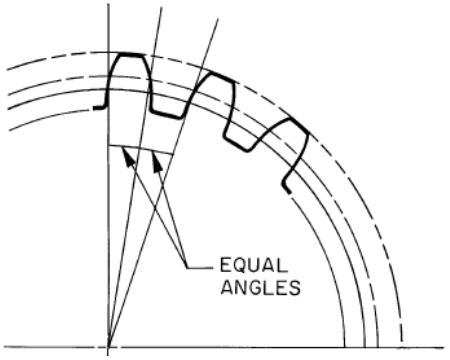
Gear pair: Two gears in mesh.
Wheel: The larger of two gears.
Pinion: The smaller of two gears.
Centre distance (c-c): The sum of the pitch radii of the two gears in mesh.
Gear ratio (u): The ratio between the number of teeth on each of the two gears. This also gives the relative speeds of each gear.
Pitch circle (PC): A circle representing the two gears as tangent cylinders. **PCD = mT,** where **T** is the number of teeth and **m** the module.
Pitch point (P): The point of contact of the two pitch circles.
Base circle: An imaginary circle from which the involute profile is generated. **BCD = PCD Cos. 20°.**
Root circle: A circle through the roots of the teeth.
Tip circle: A circle through the tips of the teeth.
Addendum (a): That part of the tooth above the pitch circle, or pitch line. **a = m.**
Dedendum (d): That part of the tooth below the pitch circle, or pitch line **d = a + clearance.**
Clearance (c): The gap left between the tip and root of two meshing teeth. $\mathbf{c = \frac{m}{4} = a - d}$
Whole depth: The addendum plus dedendum.
Working depth: The whole depth minus the clearance.
Line of action: A line that with the common tangent contains the pressure angle.
Pressure angle: Normally **20°**, but may be **14½°.**
Module (m): The module is the pitch-circle diameter divided by the number of teeth.

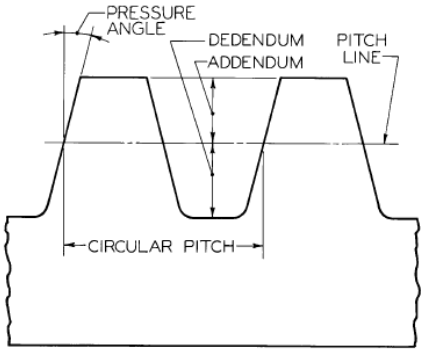
$$\mathbf{m = \frac{PCD}{T} = a}$$

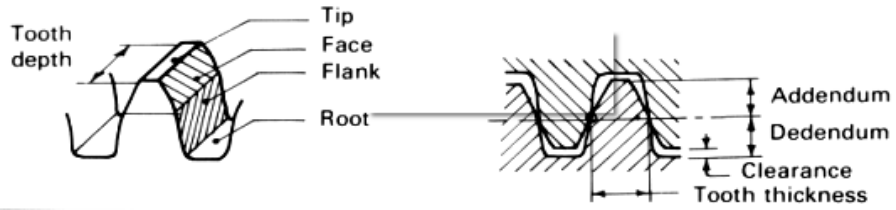
Circular pitch (p): The distance from a point on one tooth to a similar point on the next tooth. $\mathbf{p = \pi m}$
Tooth thickness: On the pitch circle, the tooth thickness $= \frac{p}{2} = \pi\frac{m}{2}$

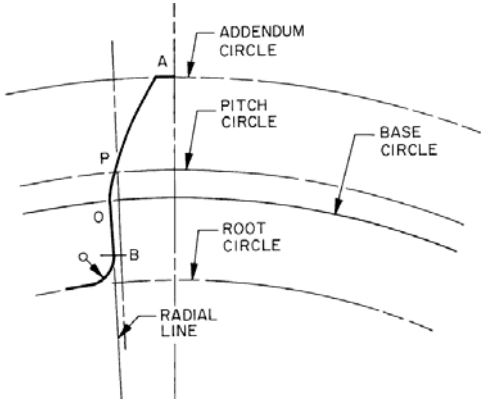



Working depth
Clearance
Addendum
Dedendum
Whole depth
Tip circle
Pitch circle
Base circle
Root circle
Pitch angle
WHEEL
Line of action
Centres distance
Pitch angle (20°)
Common tangent
PINION
Working depth
Clearance
RACK
Addendum
Dedendum
Whole depth

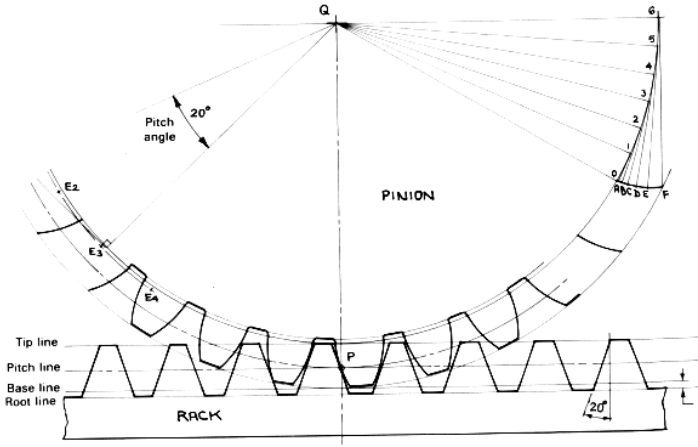

EQUAL ANGLES


PRESSURE ANGLE
DEDENDUM
ADDENDUM
PITCH LINE
CIRCULAR PITCH


Tooth depth
Tip
Face
Flank
Root
Addendum
Dedendum
Clearance
Tooth thickness


ADDENDUM CIRCLE
A
PITCH CIRCLE
BASE CIRCLE
P
O
ROOT CIRCLE
Q
B
RADIAL LINE

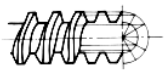
Construction by involute method



- Starting at the pressure point P and, using the same addendum, dedendum, and clearance as the pinion, set out the teeth of the rack. The sloping sides will be at an angle of **20°** with the vertical.

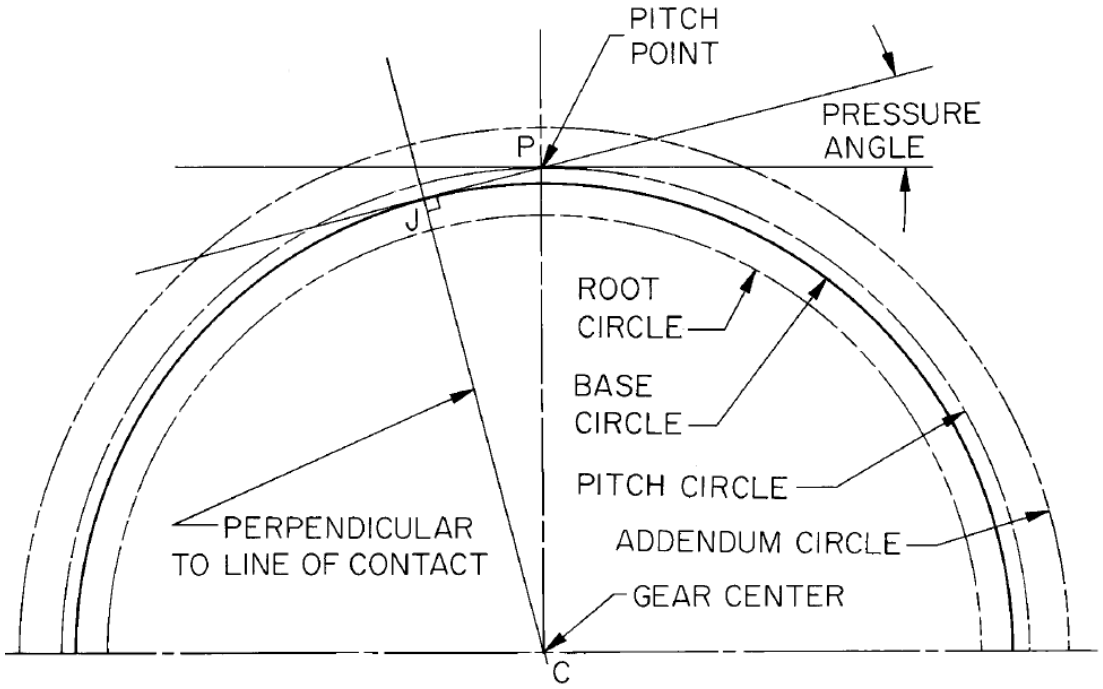
Worm gears

- These are drawn in a similar way. The rack is drawn and then turned into worm shape by plotting helices, as indicated below. See also page 176.



Notes

- *The rack may be considered as a spur gear of radius infinity.*
- *Both rack and worm gears are normally reduction gears.*



1996 HL

6. Answer SECTION A or SECTION B but not both.

SECTION A

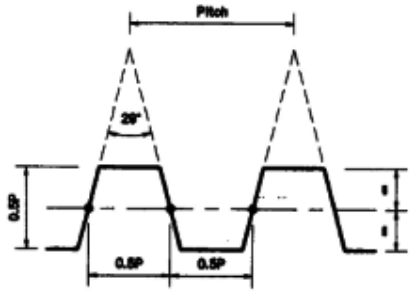
(a) Draw the profile of an acme screw thread showing two threads of pitch 40 mm, depth 20 mm and angle 29°. Title the drawing.

(b) Construct an involute curve for the quadrant of a 60 mm diameter base circle. Plot the curve for 15° intervals on the base circle.

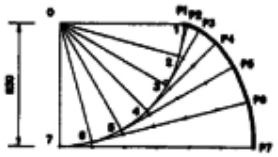
(c) Draw three teeth of a rack with module 10 mm and pressure angle 20°. Dimension the pitch, tooth thickness, addendum and dedendum.

(d) Draw or sketch a gear-type oil pump. Indicate on the diagram the direction of rotation of the gears and the flow direction through the pump.

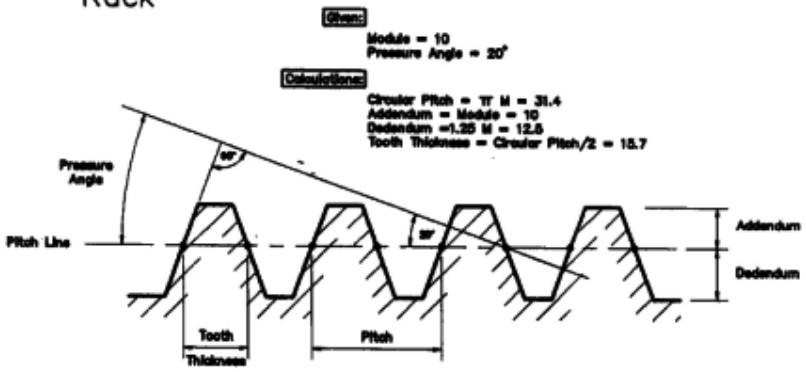
Acme Thread



Involute Curve

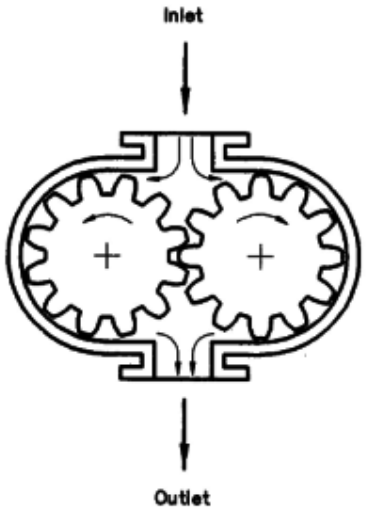


Rack



The involute rack can be regarded as a small part of an infinitely large gear wheel so that the pitch circle becomes a pitch line. Therefore the flanks of the rack are straight and normal to line of action.

Gear Pump



1995 HL

3. Details of a Bracket (Part 1), Spur Gear (Part 2) and a Spindle (Part 3) are given in Fig. 3. The Spur Gear has 20 involute teeth with module 10 mm and a pressure angle of 20°.

(a) Draw a full size sectional plan A-A showing the parts assembled. Show one involute tooth, with a full tooth space on each side, when drawing the Spur Gear. (Part 2).

(b) Insert item reference , the title IDLER GEAR and tabulate on the sheet the following values for the Spur Gear:-

Pitch circle diameter; Addendum circle diameter; Dedendum circle diameter; Base circle diameter; Circular pitch; Tooth thickness.

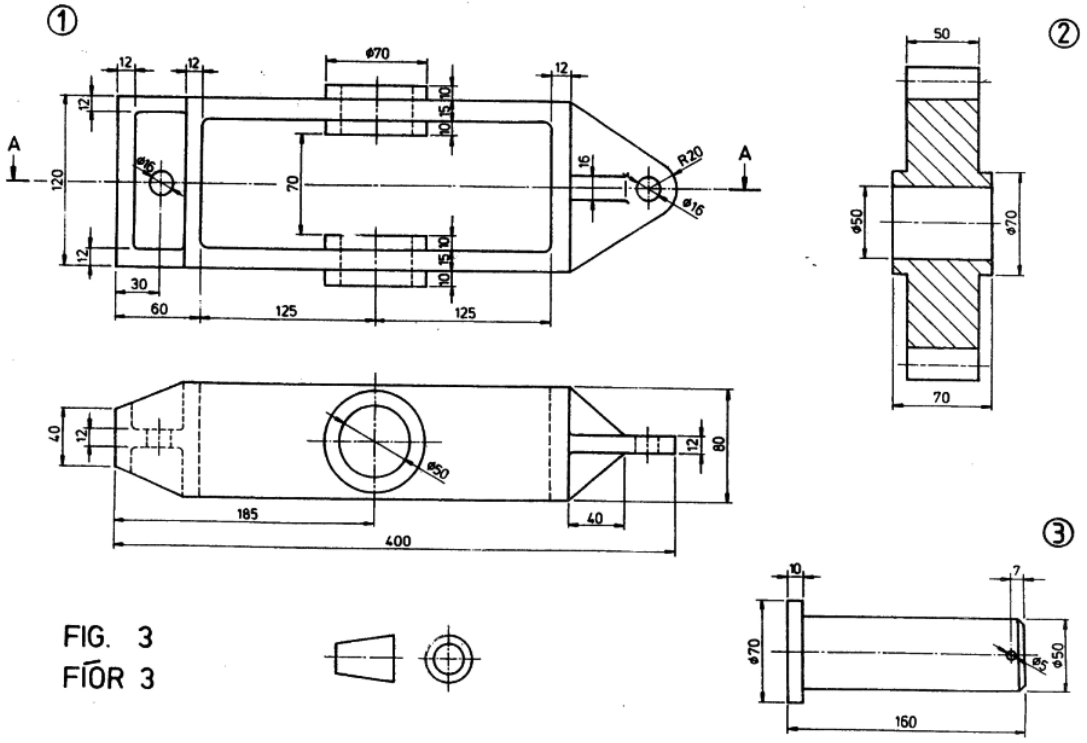
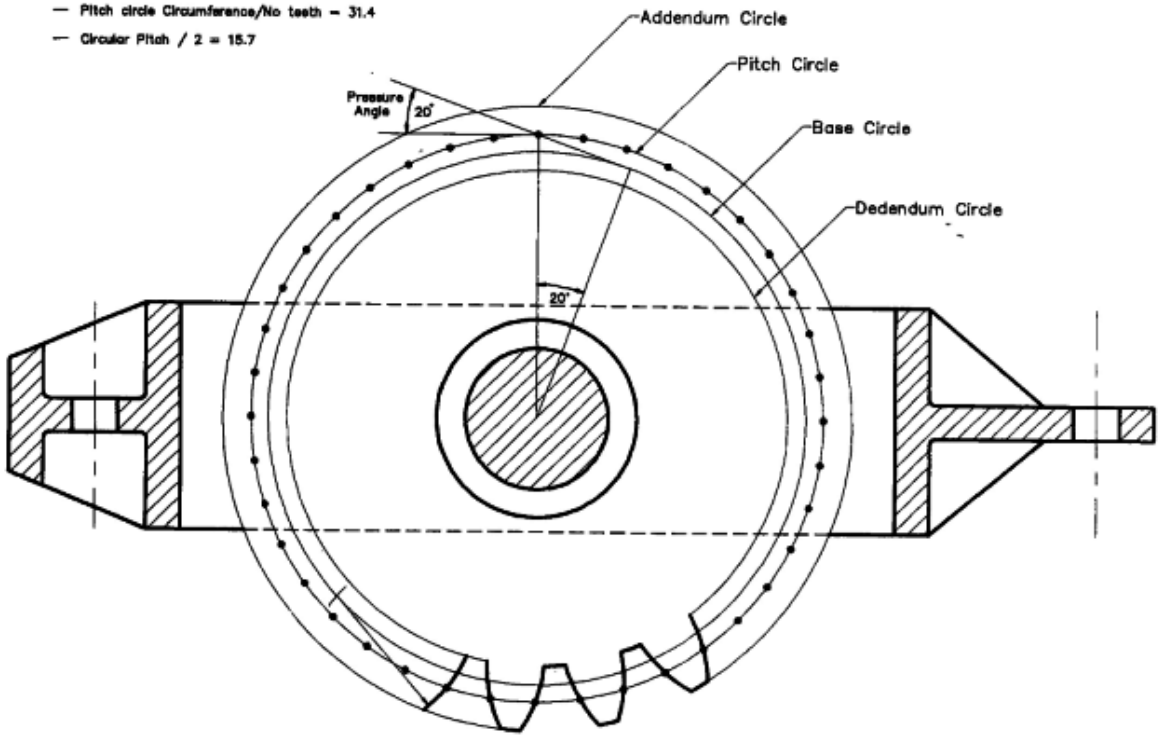


FIG. 3
FÍOR 3

Spur Gear Details

Pitch Circle Diameter	— Module x No teeth =200
Addendum Circle Diameter	— PCD + 2 Addendum = 220
Dedendum Circle Diameter	— PCD − 2 Dedendum = 175
Base Circle Diameter	— PCD x Cos 20° = 188
Circular Pitch	— Pitch circle Circumference/No teeth = 31.4
Tooth Thickness	— Circular Pitch / 2 = 15.7



Tooth Profile Radius
PCD/8 for Gears < 20Teeth
PCD/4 for Gears ≥ 20Teeth