UNSW Australia

SCHOOL OF MECHANICAL AND MANUFACTURING ENGINEERING

MMAN2300 ENGINEERING MECHANICS 2
Kinematics of Rigid Bodies

Test

Time allowed: 60 minutes

Total number of questions: Two (2)

Answer ALL questions.

Questions are of equal value.

This paper may **not** be retained by the candidate until returned in marked form.

Candidates may bring drawing instruments and electronic calculators to the examination.

Print your student number and name on top right-hand corner of this question paper.

Question 1 (10 marks)

The disk shown in Figure Q1 rotates with a constant clockwise angular velocity of 15 rad/s.
At the instant shown, use relative velocity analysis to determine:
  (a) the angular velocity (magnitude and direction) of rod *BD*,
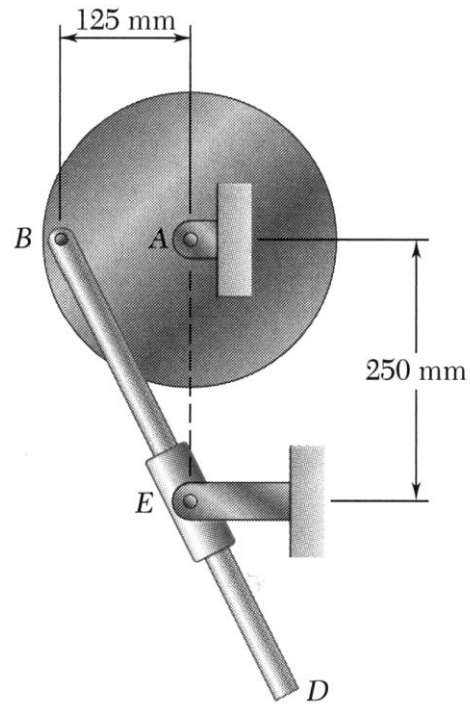 (b) the velocity (magnitude and direction) of the collar *E* relative to rod *BD*.

Figure Q1

$[\omega_{BD} = 3.0$ rad/s CW; $v_{E/BD} = 1.677$ ms/s$]$

Question 2 (10 marks)

Figure Q2 shows that a cam (2) rotates about point O and drives a reciprocating follower (3). At the point of contact there are two coincident points, P_2 on link 2 and P_3 on link 3. The cam rotates at a counter clockwise angular velocity 0.5 rad/s with respect to the frame (1).

    (a) Identify the locations of all instant centres on the figure below.

    (b) Find the magnitide and direction of the velocity of P_2.

    (c) Find the velocity of the follower (link 3).

    (d) Find the magnitude of the velocity of sliding at the point of contact.

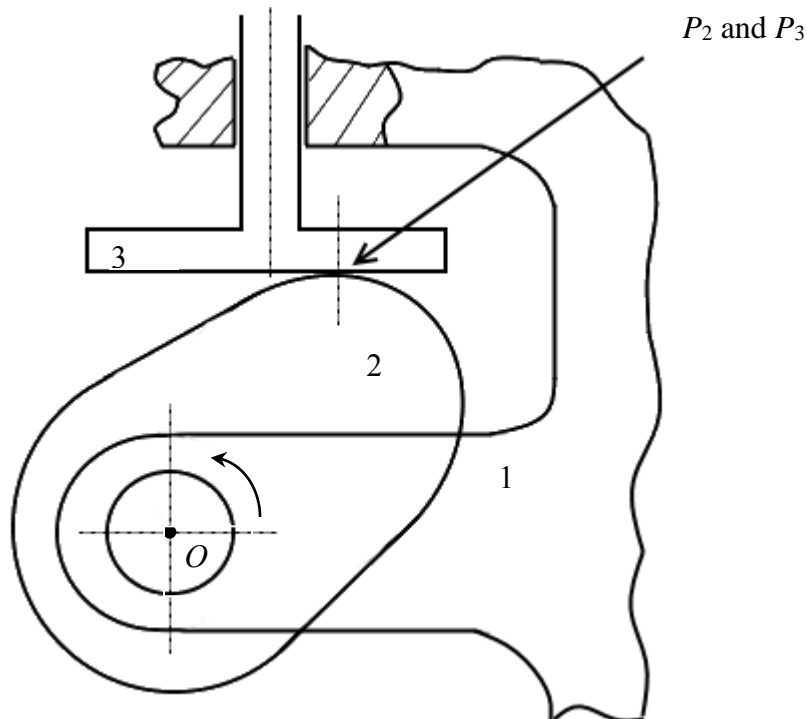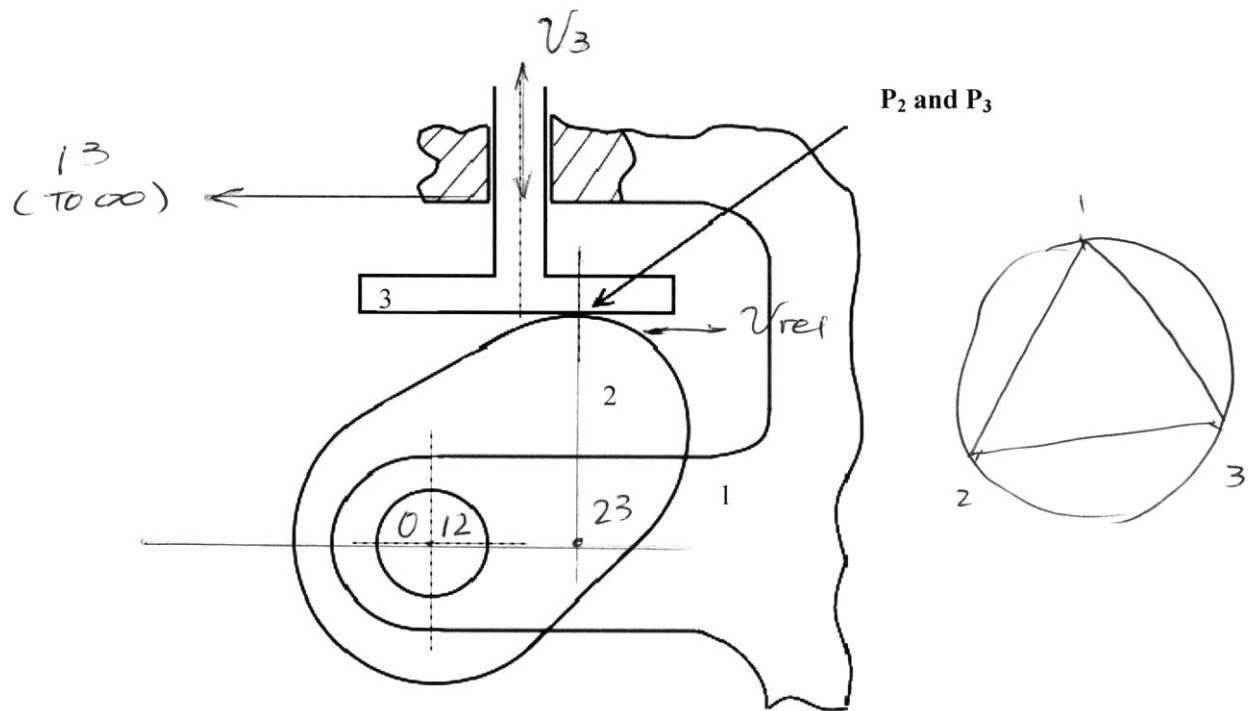Use the method of instant centre. A graphical solution is acceptable.

Figure Q2

$[v_{p2} = 0.02 \text{ m/s}; v_3 = 0.011 \text{ m/s} \uparrow; \boldsymbol{v}_{rel} = 0.0169 \text{ m/s} \leftarrow]$