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Mathematics

0580

Paper - 2

Vectors and Transformations

Exercise (M-19; M-18; S-19; S-18; W-18)

(with answers)

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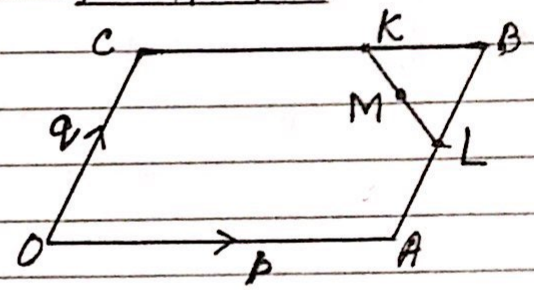
1. O is origin. $\vec{OA} = 2x + 3y$ and $\vec{BA} = x - 4y$
Find the position vector of B, in terms of x and y in its simplest form. [M-19/22/Q8] ---[2]

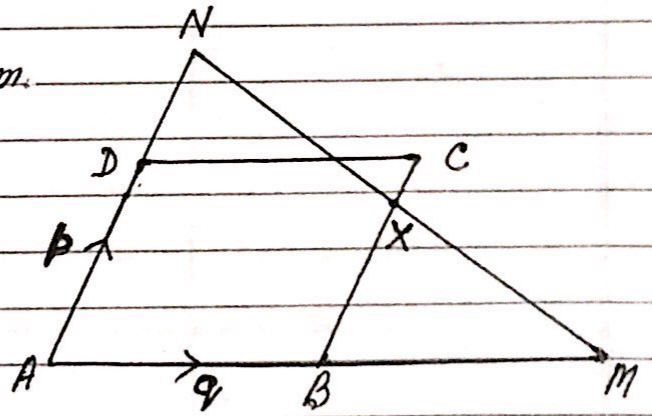
2. OABC is a parallelogram and O is the origin. $CK = 2KB$ and $AL = LB$. M is the mid point of KL. $\vec{OA} = p$ and $\vec{OC} = q$
Find, in terms of p and q, giving your answer in its simplest form.



(a) $\vec{KL}$, ---[2]

(b) the position vector of M. [S-19/21/Q25] ---[2]

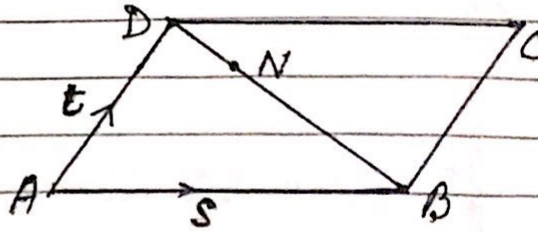
3. ABCD is a parallelogram with $\vec{AB} = q$ and $\vec{AD} = p$.
ABM is a straight line with AB : BM = 1 : 1
ADN is a straight line with AD : DN = 3 : 2



(a) Write $\vec{MN}$, in terms of p and q, in its simplest form. ---[2]

(b) The straight line MN cuts BC at X. X is the mid point of MN. $\vec{BX} = kp$
Find the value of k. [S-19/22/Q23] ---[2]

4. ABCD is a parallelogram. N is the point on BD such that BN : ND = 4 : 1. $\vec{AB} = s$ and $\vec{AD} = t$



Find in terms of s and t, an expression in its simplest form for

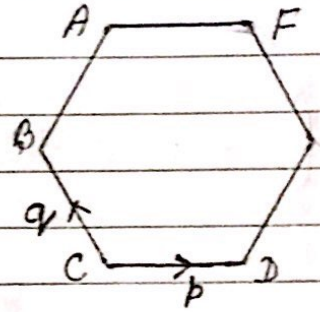
(a) $\vec{BD}$ ---[1]

(b) $\vec{CN}$ ---[3]

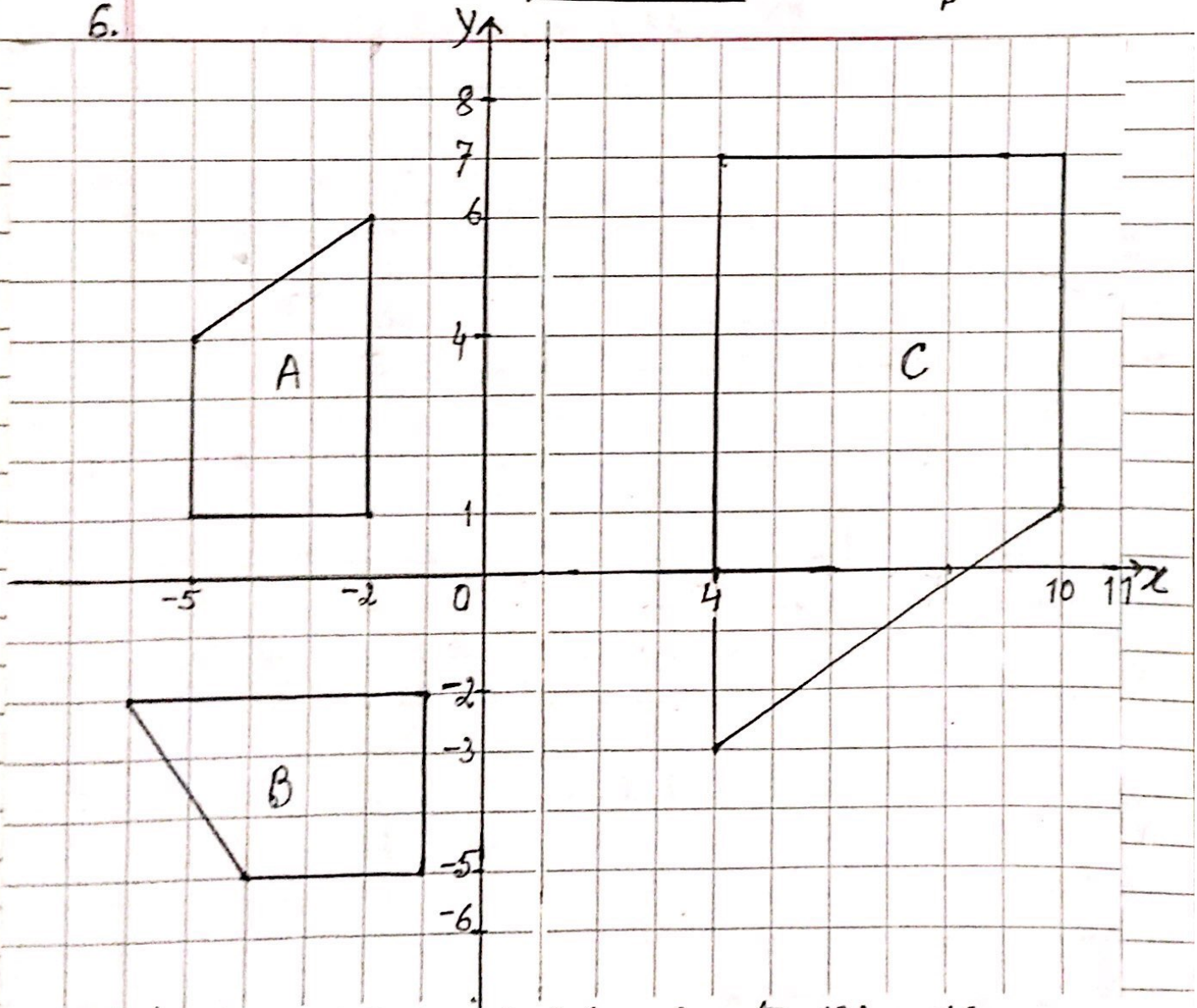
[S-19/23/Q22]

5 The diagram shows a regular hexagon ABCDEF. $\overrightarrow{CD} = p$, $\overrightarrow{CB} = q$.
Find $\overrightarrow{CA}$, in terms of p and q, giving your answer in its simplest form. ---[2]

M-18/22/Q7



6.



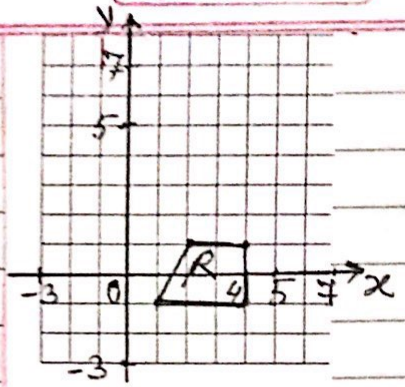
Describe fully the single transformation that maps.

(a) Shape A onto shape B. ---[3]

(b) Shape A onto shape C. ---[3]

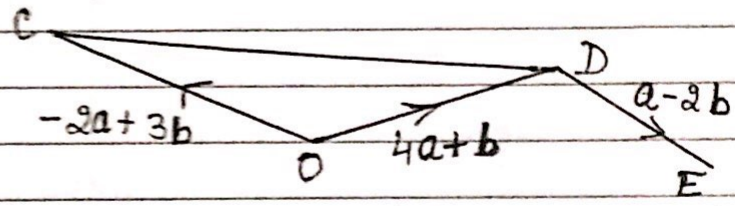
M-18/22/Q20

7. On the grid, draw the image of shape R after transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. ---[3]



S-18/21/Q16

8. In the diagram, O is the origin, $\overrightarrow{OC} = -2a + 3b$ and $\overrightarrow{OD} = 4a + b$.

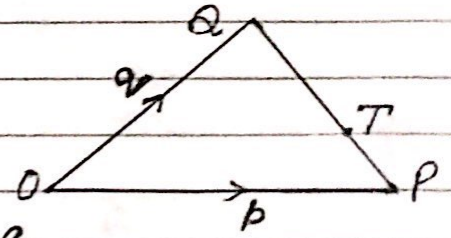


(a) Find $\overrightarrow{CD}$, in terms of a and b, in its simplest form. ---[2]

(b) $\overrightarrow{DE} = a - 2b$
Find the position vector of E, in terms of a and b in its simplest form. ---[2]

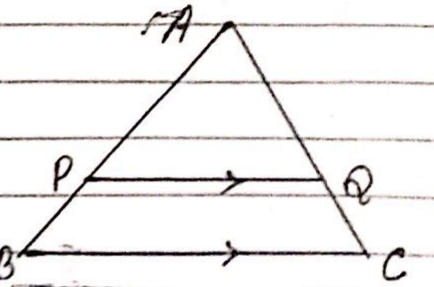
S-18/22/Q22

9. O is origin, $\overrightarrow{OP} = p$ and $\overrightarrow{OQ} = q$
$QT : TP = 2 : 1$
find the position vector of T.
Give your answer in terms of p and q, in its simplest form.

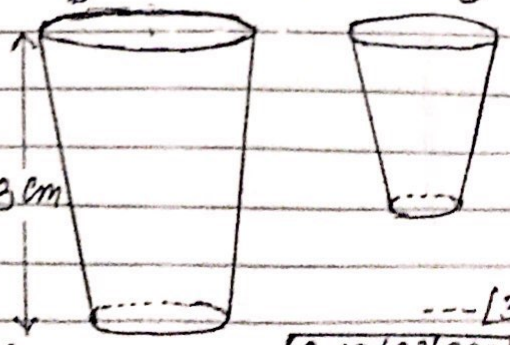


S-18/23/Q14 ---[2]

10(a) In the diagram, PQ is parallel to BC.
APB and AQC are straight lines.
PQ = 8cm, BC = 10cm and AB = 9cm,
Calculate PB. ---[2]



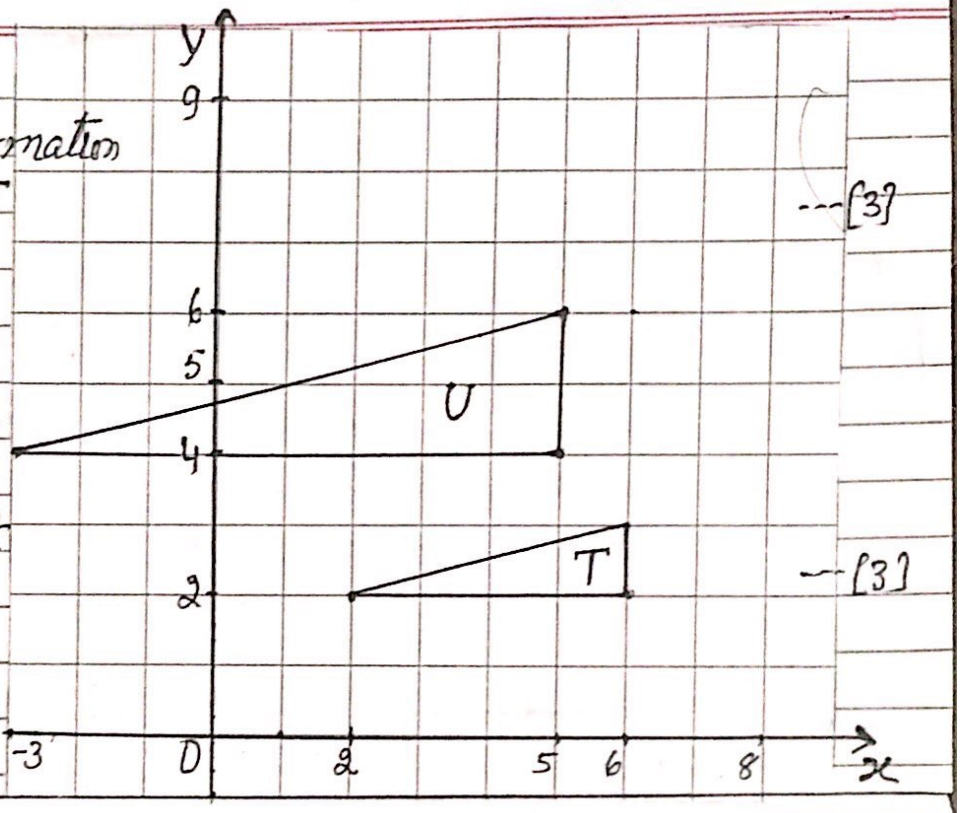
(b) The diagram shows two glasses which are mathematically similar. The larger glass has a capacity of 0.5 litres and the smaller glass has a capacity of 0.25 litres. The height of larger glass is 13 cm. Calculate the height of the smaller glass. ---[3]



S-18/23/Q25

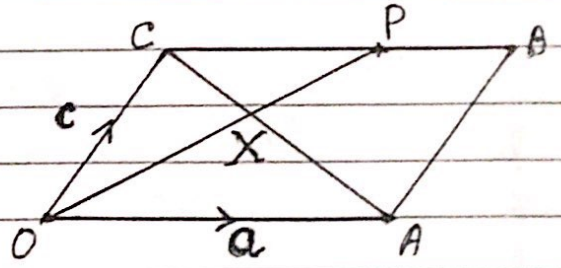
11. (a) Describe fully the single transformation that maps triangle T onto triangle U. ---[3]

(b) On the grid, draw the image of triangle T after a rotation through 90° clockwise about the point (7, 3). ---[3]



S-18/23/Q26

12. In the diagram, OABC is a parallelogram. OP and AC intersect at X, CP : PB = 2 : 1, $\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$



(a) Find $\vec{OP}$, in terms of $\mathbf{a}$ and $\mathbf{c}$, in its simplest form. --[2]

(b) CX : XA = 2 : 3

(i) Find $\vec{OX}$, in terms of $\mathbf{a}$ and $\mathbf{c}$, in its simplest form. --[2]

(ii) Find OX : XP, --[2]

W-18/23/Q26

Answers

1. $x + 7y$
2. (a) $\frac{1}{3}p - \frac{1}{2}q$
   (b) $\frac{5}{6}p + \frac{3}{4}q$
3. (a) $\frac{5}{3}p - 2q$
   (b) $\frac{5}{6}$
4. (a) $-s + t$
   (b) $-\frac{4}{5}s - \frac{1}{5}t$
5. $2q + p$
6. (a) Rotation, (centre) origin, through 90° anticlockwise.
   (b) Enlargement [centre] (0,3) (sf) -2.
7. Shape with vertices at (1,1), (1,4), (−1,2), (−1,4).
8. (a) $6a - 2b$
   (b) $5a - b$
9. $\frac{2}{3}p + \frac{1}{3}q$
10. (a) 1·8
    (b) 10·3
11. (a) Enlargement
    (scale factor) 2.
    (Centre) (7,0)
    (b) Image at (6,4); (7,4), (6,8).
12. (a) $c + \frac{2}{3}a$
    (b) (i) $\frac{2}{5}a + \frac{3}{5}c$
    (ii) 3 : 2