# 3.1

Q1- (a) $(4-1, 1-5) = (3, -4)$ ✓

(b) $(0-2, 0-3, 4-0) = (-2, -3, 4)$ ✓

Q2 (a) $(-5, 0)$ ✓

(b) $(-3, 4, 0)$ ✓

Q3 (a) $\overrightarrow{P_1P_2} = (-1, 3)$ ✓

(b) $= (-3, 6, 1)$ ✓

Q4 (a) $\overrightarrow{P_1P_2} = (2, -3)$ ✓

(b) $= (-1, 6, 1)$ ✓

Q5 (a) $A(1, 1)$ , $B(x_1, x_2)$

$(x_1 - 1 , x_2 - 1) = (1, 2)$

$x_1 = 1+1 = 2$ , $x_2 = 2+1 = 3$

T.P $= (2, 3)$ ✓

(b) $B(-1, -1, 2)$ , $\vec{u} = (1, 1, 3)$

$A = (x, y, z)$

$(-1-x , -1-y , 2-z) = (1, 1, 3)$

$-1-x = 1$ , $-1-y = 1$ , $2-z = 3$

$x = -2$ $y = -2$ $z = -1$

I.P $= (-2, -2, -1)$ ✓

Q6 (a) $(2-x, -y) = (1, 2)$

$2-x = 1$ , $-y = 2$

$x = 1$ $y = -2$

I.P $= (1, -2)$ ✓

(b) $(x, y-2, z) = (1, 1, 3)$

$x = 1$ , $y-2 = 1$ , $z = 3$

$y = 3$

T.P $= (1, 3, 3)$ ✓

Q7- (a) $\vec{OQ} - \vec{OP} = (4, -2, -1)$

$(3, 0, -5) - (x, y, z) = (4, -2, -1)$

$3-x = 4$ , $-y = -2$ , $-z-5 = -1$

$x = -1$ $y = 2$ $z = -4$

$\vec{OP} = (-1, 2, -4)$

(b) $\vec{OQ} - \vec{OP} = -(4, -2, -1)$

$(3, 0, -5) - (x, y, z) = (-4, 2, 1)$

$3-x = -4$ , $-y = 2$ , $-5-z = 1$

$x = 7$ $y = -2$ $z = -6$

$\vec{OP} = (7, -2, -6)$

Q8 (a) $\vec{OQ} - \vec{OP} = (6,7,-3)$

$\vec{OQ} = (6,7,-3) + (-1,3,-5)$

$= (5,10,-8)$ ✓

(b) $\vec{OQ} = (-6,-7,3) + (-1,3,-5)$

$= (-7,-4,-2)$ ✓

Q9- (b) $(0,5) - 3(4,-1)$

$= (0,5) - (12,-3)$

$= (-12,8)$ ✓

c) $2u - 10w$

$(8,-2) - (-30,-30)$

$= (38,28)$ ✓

Q12 d) $\frac{1}{2}\left[ (7,1,-4,-2,3) - 5(0,4,-1,1,2) + 2(1,2,-3,5,0) \right] + (0,4,-1,1,2)$

$= \frac{1}{2}\left[ (7,1,-4,-2,3) - (0,20,-5,5,10) + (2,4,-6,10,0) \right] + (0,4,-1,1,2)$

$= \frac{1}{2}(9,-15,-5,3,-7) + (0,4,-1,1,2)$

$= \left(\frac{9}{2}, -\frac{15}{2}, -\frac{5}{2}, \frac{3}{2}, -\frac{7}{2}\right) + (0,4,-1,1,2)$

$= \left(\frac{9}{2}, -\frac{7}{2}, -\frac{7}{2}, \frac{5}{2}, -\frac{3}{2}\right)$ ✓

Q14- $u = (1,2,-3,5,0)$ , $v = (0,4,-1,1,2)$ , $w = (7,1,-4,-2,3)$

$2u - v + x = 7x + w$

$(2,4,-6,10,0) + (0,-4,1,-1,-2) + x = 7x + (7,1,-4,-2,3)$

$x + (2,0,-5,9,-2) = 7x + (7,1,-4,-2,3)$

$6x = (-5,-1,-1,11,-5)$

$x = \left(-\frac{5}{6}, -\frac{1}{6}, -\frac{1}{6}, \frac{11}{6}, -\frac{5}{6}\right)$ ✓

Q13- $u = (-3,2,1,0)$ , $v = (4,7,-3,2)$ , $w = (5,-2,8,1)$

$3u + v - 2w = 3x + 2w$

$3x = 3u + v - 4w$

$3x = (-9,6,3,0) + (4,7,-3,2) - (20,-8,32,4)$

$3x = (-25, 21, -32, -2)$

$x = \left(-\frac{25}{3}, 7, -\frac{32}{3}, -\frac{2}{3}\right)$ ✓

Q15- (a) Not parallel ✓ as $v = ku$ not satisfied

(b) Parallel ✓

(c) Parallel ✓ $u = kv \Rightarrow u = 0v = 0$

Q16- $u = (4,-1)$

(a) $u = kv$

$(4,-1) = k(8t,-2)$

$8tk = 4$ , $-2k = -1$

$8t\left(\frac{1}{2}\right) = 4$ , $k = \frac{1}{2}$

$t = 1$

$v = ku$

$(8t,-2) = k(4,-1)$

$8t = 4k$ , $-k = -2$

$t = 1$ , $k = 2$

$t = 1$ only

(b) ★ $u = (4,-1)$

$(8t, 2t)$

$u = kv$ , $v = bu$

$(4,-1) = k(8t,2t)$ , $(8t,2t) = b(4,-1)$

$8tk = 4$ , $2kt = -1$ , $8t = 4b$ , $2t = -b$

$8t\left(\frac{-1}{2t}\right) = 4$ , $k = \frac{-1}{2t}$ , $8t = 4(-2t)$ , $b = -2t$

$-4 \neq 4$

$8t = -8t$

$16t = 0$

$t = 0$

parallel if $t = 0$

(c) $(1, t^2)$

$u = av$

$(4,-1) = a(1,t^2)$

$a = 4$ , $at^2 = -1$

$t^2 = -\frac{1}{4}$ , not possible

$v = bu$

$(1,t^2) = b(4,-1)$

$4b = 1$ , $t^2 = -b$

$b = \frac{1}{4}$ , $t^2 = -\frac{1}{4}$ ; not possible

→ not parallel

· Linear Combinations: $w = k_1v_1 + k_2v_2 \cdots k_rv_r$

Q17- $u = (1,-1,3,5)$ , $v = (2,1,0,-3)$ → use Gauss-jordan elimination method for show a's 21-22

$au + bv = (1,-4,9,18)$

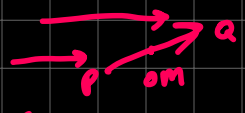
$a(1,-1,3,5) + b(2,1,0,-3) = (1,-4,9,18)$

$(a+2b, b-a, 3a, 5a-3b) = (1,-4,9,18)$

$3a = 9$ , $b - a = -4$

$a = 3$ , $b - 3 = -4$

$b = -1$



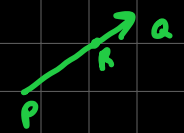

$\vec{PM} = \vec{OM} - \vec{OP}$

$\frac{1}{2}\vec{PQ} + \vec{OP} = \vec{OM}$

★ Q23-

(a) mid-point $= \left(\frac{9}{2}, -\frac{1}{2}, -\frac{1}{2}\right)$ ✓

(b) $\vec{PQ} = (5,-7,3)$




$\frac{3}{4}\vec{PQ} = \left(\frac{15}{4}, -\frac{21}{4}, \frac{9}{4}\right)$

$\vec{OR} = \vec{OP} + \frac{3}{4}\vec{PQ}$

$= (2,3,-2) + \left(\frac{15}{4}, -\frac{21}{4}, \frac{9}{4}\right)$

$= \left(\frac{23}{4}, -\frac{9}{4}, \frac{1}{4}\right)$ ✓