Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Topic 4 Review (Vectors)**

1. Consider the points A (1, 5, 4), B (3, 1, 2) and D (3, *k*, 2), with (AD) perpendicular to (AB).

(a) Find

(i)

(ii) , giving your answer in terms of *k*.

(b) Show that *k* = 7

The point C is such that  = 

(c) Find the position vector of C

(d) Find cos 

2. Let ***v*** = 3***i*** + 4 ***j*** + ***k*** and ***w*** = ***i*** + 2 ***j*** – 3***k***. The vector ***v*** + *p****w*** is perpendicular to ***w***.

Find the value of *p*.

3. The point O has coordinates (0, 0, 0), point A has coordinates (1, –2, 3) and point B has coordinates (–3, 4, 2).

(a) (i) Show that  = 

(ii) Find 

(b) The line *L*1 has equation 

Write down the coordinates of two points on *L*1.

(c) The line *L*2 passes through A and is parallel to.

(i) Find a vector equation for *L*2, giving your answer in the form ***r*** = ***a*** + *t****b***.

(ii) Point C (*k*, –*k*, 5)is on *L*2. Find the coordinates of C.

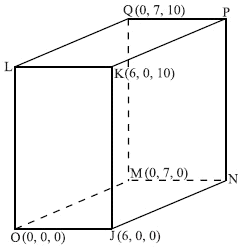
(d) The line *L*3 has equation  and passes through the point C.

Find the value of *p* at C.

4. The line *L*1 is represented by ***r***1 =  and the line *L*2 by ***r***2 = 

The lines *L*1 and *L*2 intersect at point T. Find the coordinates of T.

5. The diagram below shows a cuboid (rectangular solid) OJKLMNPQ. The vertex O is (0, 0, 0), J is (6, 0, 0), K is (6, 0, 10), M is (0, 7, 0) and Q is (0, 7, 10).



(a) (i) Show that  = .

(ii) Find .

(b) An equation for the line (MK) is ***r*** = .

(i) Write down an equation for the line (JQ) in the form ***r*** = ***a*** + *t****b***.

(ii) Find the acute angle between (JQ) and (MK).

(c) The lines (JQ) and (MK) intersect at D. Find the position vector of D.

1. The line L1 is represented by the vector equation .

A second line L2 is parallel to L1 and passes through the point B(-8, -5, 25).

1. Write down a vector equation for L2 in the form ***r*** = ***a*** + t***b***.

A third line L3 is perpendicular to L1 and is represented by .

1. Determine the value of k. Show the work that leads to your answer.
2. The lines L1 and L3 intersect at point A. Find the coordinates of A. SHOW ALL WORK.
3. Find AB.



The lines L2 and L3 intersect at point C where

1. Find the coordinates of point C.
2. Point A is (2, 3, 1), B is (4, -5, 21) and O is (0,0,0).
   1. Find the unit vector **u** in the direction of AB.
   2. Show that **u** is perpendicular to the vector OA.
   3. S is the midpoint of segment AB. Determine the coordinates of S.
   4. Write a vector equation of the line that passes through point S and is parallel to OA (this is line L1)
   5. Line 2 has the equation ***r*** = <5,10, 10 ***>*** + *s* <−2,5,−3***>***. Explain why L1 and L2 are not parallel.
   6. The lines L1 and L2 intersect at the point P. Find the position vector of P.