Maths assignment

1CWK50

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# Question 1

Given that *U* = {1, 2, 3,…,10} is the universal set, *A* = { : , is an odd number}  
*B* = { : , is a square number} and *C* = { : , }, find the following:

1. |*A*|, |*A B*|, |*C*|; **[4]**
2. *P(B)*;**[3]**
3. C’, *B* x *C*, *A*  *C*, *C* \ *B*. **[8]**

**[15 marks for this question]**

## Question 1: Answer

*U* = {1, 2, 3,…, 10}  
*A* = { : , is an odd number}  
*B* = { : , is a square number}  
*C* = { : , }

1. **|*A*|:**

Set A = {1, 3, 5, 7, 9}

**|*A*| = 5**

**|*A B*|:**

Set A = {1, 3, 5, 7, 9}

Set B = {1, 4, 9}

*A B* = {1, 9}

**|*A B*| = 2**

**|*C*|:**

Set C = {2, 3, 4}

**|*C*| = 3**

1. ***P(B)*:**

Set B = {1, 4, 9}

***P(B)* = { , {1}, {4}, {9}, {1, 4}, {1, 9}, {4, 9}, {1, 4, 9} }**

1. **C’:**

*U* = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

Set C = {2, 3, 4}

***C’* = {1, 5, 6, 7, 8, 9, 10}**

***B* x *C*:**

Set B = {1, 4, 9}

Set C = {2, 3, 4}

***B* x *C* = { (1, 2), (1, 3), (1, 4), (4, 2), (4, 3), (4, 4), (9, 2), (9, 3), (9, 4) }**

***A*  *C*:**

Set A = {1, 3, 5, 7, 9}

Set C = {2, 3, 4}

***A*  *C* = {3}**

***C* \ *B*:**

Set C = {2, 3, 4}

Set B = {1, 4, 9}

***C* \ *B* = {2, 3}**

# Question 2

1. Draw a Venn diagram to represent the following sets: **[6]**

*U* = { : , 36}

*F* = { : , is a prime number, }

*G* = { : , is a multiple of 3, }

*H* = { : , is a factor of 36}

1. Use a Venn diagram to illustrate the following: **[4]**
   1. (*A B*) C’
   2. (*B C*) \ *A’*

**[10 marks for this question]**

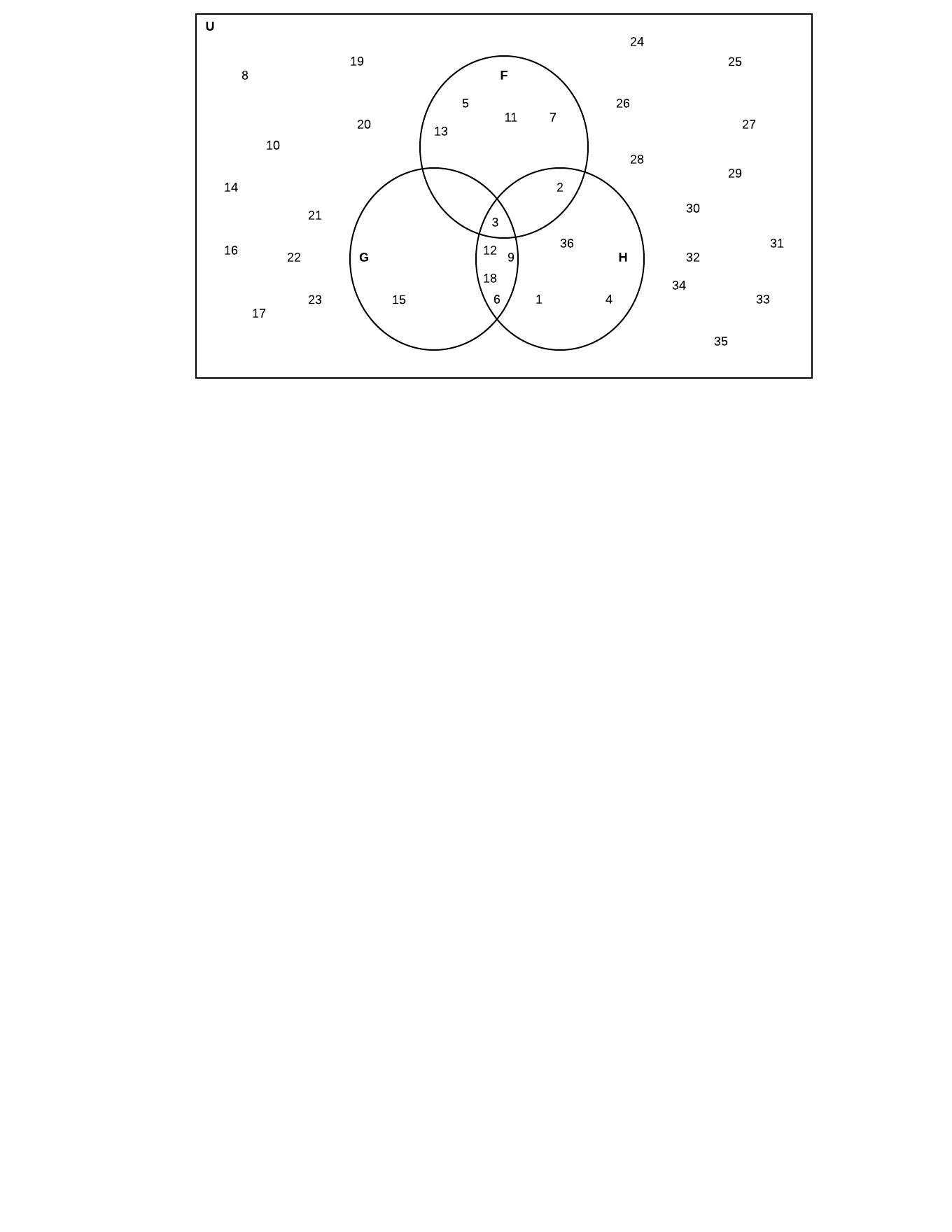
## Question 2: Answer

1. *U* = { : , 36}

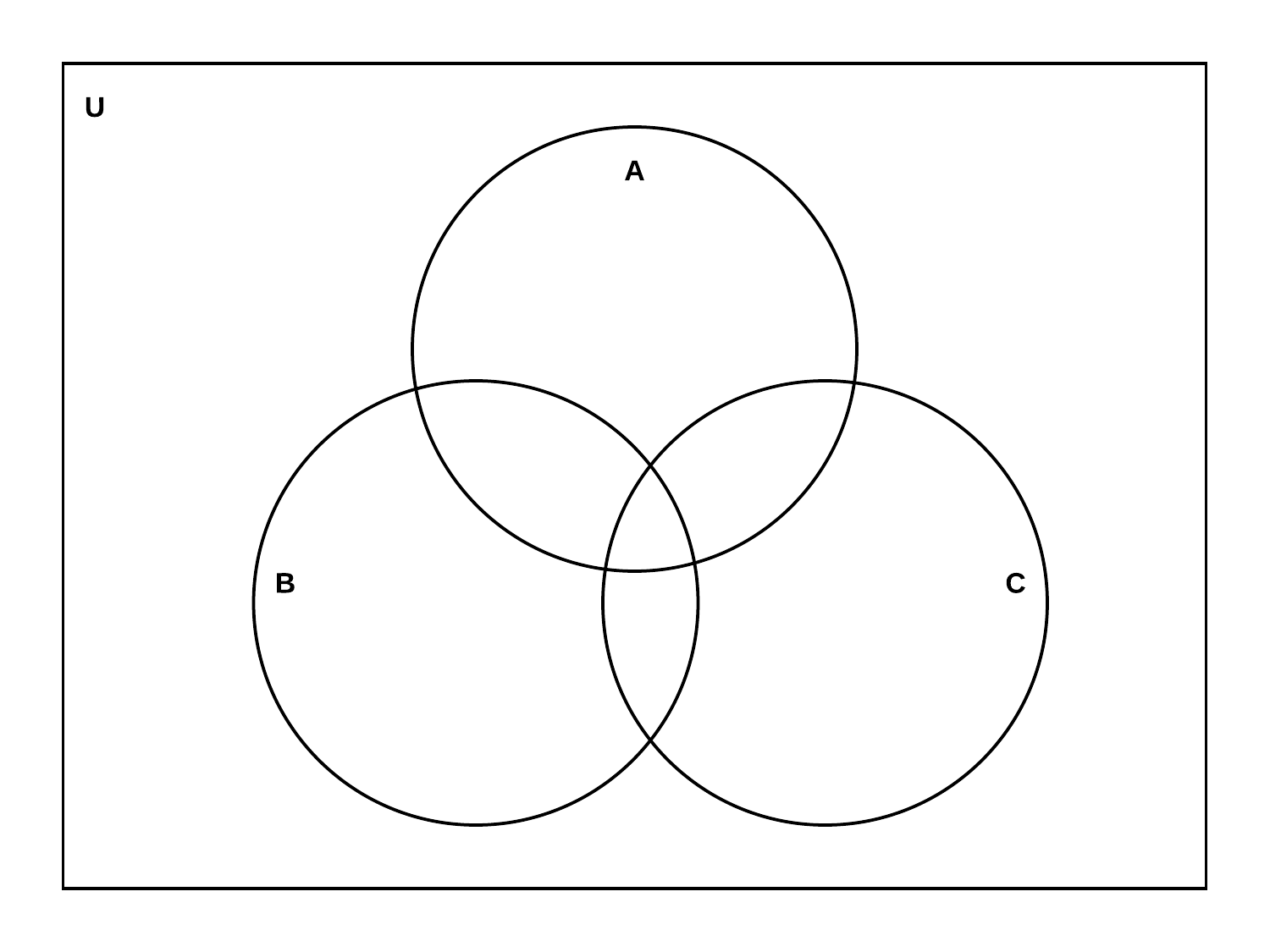
*F* = {2, 3, 5, 7, 11, 13}

*G* = {3, 6, 9, 12, 15, 18}

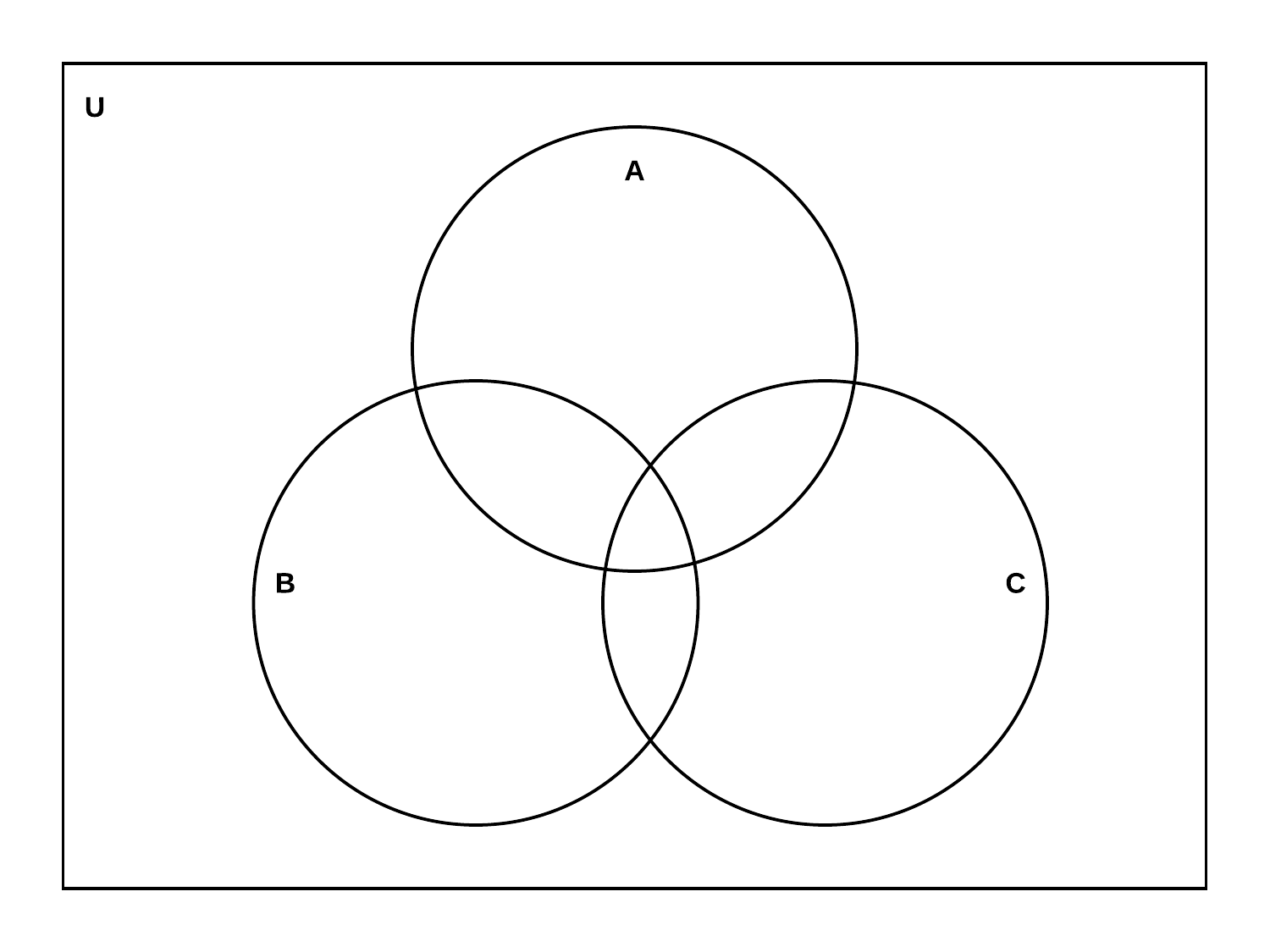
*H* = {1, 2, 3, 4, 6, 9, 12, 18, 36}



1. (*A B*) C’:



1. (*B C*) \ *A’*:



# Question 3

For the three vectors, **a** = 2 – 3 – , **b** = – 2 – and **c** = – – :

1. calculate **a** + 2**c [3]**
2. the unit vector in the direction of **c [3]**
3. calculate **a**.**c** and find the angle between the two vectors **[5]**
4. calculate **a** x **b [4]**

**[15 marks for this question]**

## Question 3: Answer

**a** = 2 – 3 –   
**b** = – 2 –   
**c** = – –

1. **a** + 2**c :**

**a** = 2 – 3 –

**c** = – –

2**c** = 2( – – )  
 = 2 – 2 – 2

**a** + 2**c** = (2 – 3 – ) + (2 – 2 – 2)

**a** + 2**c** = 4 – 5 – 3

1. **c** = – –

=

1. **a** = 2 – 3 –

**c** = – –

**a** . **c** =(2 – 3 – ) . ( – – )

= (2 x 1) + (-3 x -1) + (-1 x -1)

= (2) + (3) + (1)

**a .** **c** = 6

||**a**|| =

=

||**a**|| =

||**c**|| =

=

||**c**|| =

= (to 3sf)

1. **a** = 2 – 3 –   
   **b** = – 2 –

**a** x **b** =

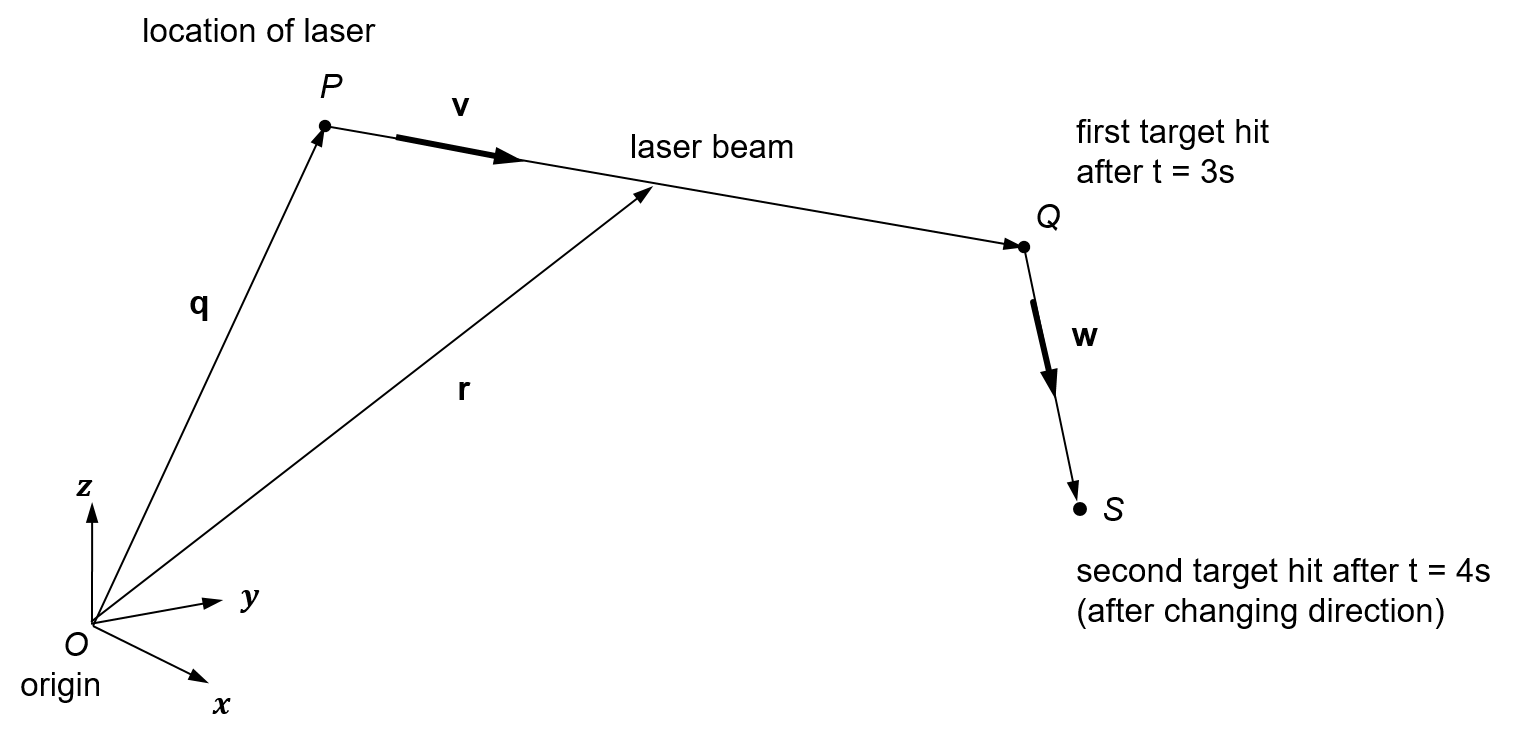
= ((-3 x -1) – (-1 x -2)) + ((-1 x 1) – (2 x -1)) + ((2 x -2) – (-3 x 1)

= (3 – 2) + (-1 + 2) + (-4 + 3)

**a** x **b** = + -

# Question 4

In a computer game, a laser gun is fired from a point given by the position vector  
**q** = (10, -10, 20) in the direction given by **v** = (20, -30, 10). Calculate:



1. the coordinates of the point where the laser hits a target after time, t = 3 **[5]**
2. the total distance travelled by the laser, if the laser changes direction after hitting the first target along the vector **w** = (5, 10, 30) to hit another target after t = 4. **[5]**

**[10 marks for this question]**

## Question 4: Answer

1. **r** = **q** + **v**t

**r** = ?

**q** = (10, -10, 20)

**v** = (20, -30, 10)

t = 3

**r** = (10, -10, 20) + 3(20, -30, 10)

= (10, -10, 20) + (60, -90, 30)

**r** = (70, -100, 50)

1. **r** = **q** + **v**t

**r** = ?

**q** = (70, -100, 50)

**v** = (5, 10, 30)

t = 4

**r** = (70, -100, 50) + 4(5, 10, 30)

= (70, -100, 50) + (20, 40, 120)

**r** = (90, -60, 170)

Point P is at (10, -10, 20)

Point Q is at (70, -100, 50)

Point S is at (90, -60, 170)

=

=

=

=

Total distance travelled (P to S) =

Total distance travelled (P to S) = 240.31 (to 2dp)

# Question 5

You are given the following matrices:

*U* = *V* = *W* = *Z* =

1. Write down matrix elements , , , , and if possible. Explain why if not possible.  **[6]**
2. Calculate the following if possible and explain why if not possible:
3. *V* + *W*  **[2]**
4. *V* – *Z* **[3]**
5. *UVT* **[6]**
6. *WZ* **[4]**
7. If a point (3, 1) is reflected about the line y= with , find the reflection line and the reflection point. **[4]**

**[25 marks for this question]**

## Question 5: Answer

*U* = *V* = *W* = *Z* =

1. = 3

= 0

: not possible as matrix V only has 2 rows

= 5

= 5

: not possible as matrix Z only has 2 rows

1. *V* + *W* :

*V* + *W* 󠇔 +

**Not possible** as matrix V has 2 rows and 3 columns, whereas, matrix W has 2 rows and 2 columns

matrices V and W are not the same size so matrix addition cannot be done

1. *V* – *Z* :

*V* – *Z* -

*V* – *Z*

1. *UVT*:

*VT* =

*UVT* =

=

=

*UVT* =

1. *WZ*:

*WZ* =

=

=

*WZ* =

1. point (3, 1) is reflected about y=

,

line of reflection:

point of reflection:

# Question 6

For the three functions, , and  
, where *R* is the set of the real numbers:

1. Write down the composite functions , ; **[5]**
2. Find the values of the composite function, , for . **[5]**

**[10 marks for this question]**

## Question 6: Answer

1. :

=

:

=

when :

=

= 4(1+1+1)

= 12

when :

=

=

= 4

when :

=

=

= 12

# Question 7

Given the relation below, defined on , where *R* is the set of the real numbers:

1. Explain when *b* is a function and write down the three values of , for  
   , using the ordered pair representation; **[5]**
2. if the relation is a function, state whether it is a total or partial function and classify it as an injection, surjection, bijection or a combination of these; **[4]**
3. find the inverse function and determine the domain and the range that make the relation a function; **[4]**
4. explain why the values and are not valid for these functions. **[2]**

**[15 marks for this question]**

**[Total: 100 marks]**

## Question 7: Answer

1. b is a function when

when :

when ,

when :

when ,

when :

when ,

ordered pair representation:

{(0, -2), (2, 6), (3, 4)}

1. b is a partial injection
2. :

domain:

range:

1. is not possible as when = 1. cannot tend to infinity.

is not possible as when . cannot tend to infinity.