# Winter

## Q1

1. In a game, an Archer will hit a target, if he is facing the target, which in this case means the angle to target is less than 90 degrees.

Vector3 Target = new Vector3(38, 7, 100);

Vector3 ArcherPosition = new Vector3(10, 0, 156);

Vector3 ArcherForward = Vector3.normalise(new Vector3 (-2, 1, -2));

* + 1. Find the vector from the Archer to the Target

(38, 7, 100) – (10, 0, 156)

**= (28, 7, -56)**

* + 1. How far is the Archer from the Target?

√ (28² + 7² + 56²)

= √ (784 + 49 + 3136)

= √ (3969)

**= 63**

* + 1. Calculate ArcherForward.

√ (2² + 1² + 2²)

= √ (4 + 1 + 4)

= √ (9)

= 3

**AcherForward = Vector3(-2/3, 1/3, -2/3)**

* + 1. Use Scalar Products to determine if Archer is facing the target.

(-2/3, 1/3, -2/3) · (28/63, 7/63, -56/63)

= (-2/3, 1/3, -2/3) · (4/9, 1/9, -8/9)

= (-8/27, 1/27, 16/27)

= 9/27

= 1/3

**1/3 > 0, therefore Archer is facing target.**

* + 1. A successful attack is permitted if the distance is less than 80m, and the Archer is facing the target. Will this attack be successful?

63m < 80m

1/3 > 0

**Attack is successful.**

* + 1. What is the direction of for the arrow?

**(28/63, 7/63. -56/63)**

* + 1. Given the arrow has a fixed speed of "ArrowSpeed" how would you assign the initial velocity to the arrow.

**( ((28/63)\*ArrowSpeed), ((7/63)\*ArrowSpeed), ((-56/63)\*ArrowSpeed) )**

* 1. Frame rates are a key consideration when implementing movement, and in particular keeping movement Frame Rate Independent
     1. What are the physical rules governing motions that are used to ensure Frame Rate Independence?

**Time.deltaTime**

* + 1. Illustrate (code or pseudo code) how Frame Rate Independent motion could be implemented.

**transform.position += transform.forward \* Time.deltaTime**

* + 1. Illustrate how forces could be applied to an object, giving justification with reference to the appropriate physics formula.