

# SPORT SPECIFIC QUESTIONS

**BASKETBALL ANSWERS**

**Quintic<sup>®</sup>**

*# 1 for Sports Analysis*

## Basketball Answers

Basketball is an exciting and fast paced game. It requires shooting, passing, catching, bouncing skills often while jumping and running. Watch the following video clips and answer the following questions to gain a better understanding of this sport.

Quintic Video Files you will use for these questions:

- 1) Boxing out 3
- 2) Lay-up 3
- 3) Pass-Shoot2-SV
- 4) Free-throw-sv1
- 5) Rebound 1
- 6) Lay-up 3(left)
- 7) Over head pass1-sv
- 8) Javelin pass 1-sv
- 9) Lay-up 2(left)
- 10) Defence 2-fv
- 11) Free throw sv 3

### PLAY AND PAUSE

Open the video file 'Boxing out 3'

- 1) Watch the video at full speed by pressing this button: 

- (i) Watch the clip a number of times at full speed and then at slow\* 8. If you were a basketball coach, at which speed would you view the video clip if you were meeting with the player to discuss their technique. Explain your answer.

*The slower speed would be more useful as this will allow the coach and athlete to analyse the different stages of the skill.*

- (ii) Now watch the video through frame-by-frame. Write a description of the boxing out technique as if you were teaching this defensive skill to a novice player:

*The player starts with their feet at shoulder width apart facing the attacking player. Knees and hips are slightly flexed with the left arm in the air above the player's head. As the attacking player shoots, the defending player drops her left arm and rotates 180° so the defender is now facing away from the attacker. The defender now places her feet further apart giving her a wider stance to help block off the attacker. Hips and knees still remain flexed and the defender now also has both arms in the air above her head with both elbows flexed.*

### Open the video file 'Lay-up 3'

- 2) Scroll the video to the frame at which the player leaves the ground.
- (i) Which frame is this?  
*Frame 26*
  - (ii) In this frame, which points are identified by these coordinates:
    - a) X = 288.00 Y = 470.00  
*The player's right toes*
    - b) X = 303.00 Y = 392.00  
*The player's right knee*
    - c) X = 278.00 Y = 50.00  
*The basketball hoop*
    - d) X = 323.00 Y = 317.00  
*The player's right elbow*

### TIMING

### Open the video file 'Pass-Shoot2-SV'

- 3) Set your markers at frames **18, 24, 45, 59, 66, 75**.

These frames mark significant points during the action and you can use the stopwatch function to find the time differences between these points.

- (i) Use the options from the box to complete the table below matching up the frame numbers, description of key frames and time differences.

| <u>Frame Number</u> | <u>Description</u>                  | <u>Time Differences</u> |
|---------------------|-------------------------------------|-------------------------|
| • 18                | • Player is totally off the floor   | • 0.18                  |
| • 24                | • Right toes reaches black line     | • 0.14                  |
| • 45                | • Player catches the ball           | • 0.28                  |
| • 59                | • Player lands back on the floor    | • 0.42                  |
| • 66                | • Player has released the ball      | • 0.12                  |
| • 75                | • Left leg has crossed the red line |                         |


| <b>Frame</b> | <b>Description</b>                | <b>Time difference (Seconds)</b> |
|--------------|-----------------------------------|----------------------------------|
| 18           | Player catches the ball           | 0.12                             |
| 24           | Left leg has crossed the red line | 0.42                             |
| 45           | Right toes reaches black line     | 0.28                             |
| 59           | Player is totally off the floor   | 0.14                             |
| 66           | Player has released the ball      | 0.18                             |
| 75           | Player lands back on the floor    |                                  |

### Open the video file 'Free-throw-sv1'

- 4) Use your markers and the stopwatch function to find the time difference between:
- (i) 'The ball making contact with the floor' and 'the ball returning to the player's hand.'  
*0.22 seconds (frame 47 - 58)*
  - (ii) Frame 95 and 'right heel leaves the floor'  
*0.84 seconds (frame 137)*
  - (iii) Frame 143 and 'release of the ball'.  
*0.18 seconds (frame 152)*
  - (iv) Frame 0 and 'release of the ball'.  
*3.04 seconds*
  - (v) Why is it important for the player to release the ball at the right time? Explain your answer.  
*It is important for the player to release the ball at the right height because if the ball is released too low or too high, it will minimise the chances of going in the basket.*

### ANGLES AND SHAPES

#### Open the video file 'Rebound - 2'

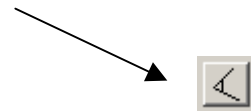
- 5)
- (i) Every 10 frames from frame 0, draw a red circle around the ball, and a red line linking each of the circles to show the path of the ball. (See example below).
  - (ii) Create a 'Single Image Capture' of this image using this button  (An arrow points from the text 'this button' to the icon.)
  - (iii) Save this as a JPEG.
  - (iv) Open this JPEG in Microsoft Word and give it an appropriate title, including your name.
  - (v) Ask your teacher if you may print it.



Open the video file ‘Lay - up3 (left)’

6) Set the Zoom to 1.2.

- (i) Every 10 frames between frame 0 and 130 draw the following angles and write down its value.



Frame 0: angle of the right elbow:

*175°*

Frame 10: angle of the right knee:

*171.99°*

Frame 20: angle of the right knee:

*154.29°*

Frame 30: angle of the left ankle:

*113.85°*

Frame 40: angle of the left elbow:

*106.22°*

Frame 50: angle of the right knee:

*146.94°*

Frame 60: angle of the left elbow:

*127.83°*

Frame 70: angle of the right hip:

*177.14°*

Frame 80: angle of the right knee:

*153.96°*

Frame 90: angle of the left elbow:

*103.03°*

Frame 100: angle of the left knee:

*158.67°*

Frame 110: angle of the left hip:

*172.12°*

Frame 120: angle of the left shoulder (hip-shoulder-elbow):

*78.89°*

Frame 130: angle of the left ankle:

*123.90°*

**SYNCHRONISATION– (Quintic Sports, Quintic Coaching and Quintic Biomechanics only)**

**Open the video file ‘Over head pass1 - sv’ in the Main window**

**Open the video file ‘Javelin pass1 - sv’ in the Best window**

**7)**

- (i) Scroll to the frame in both videos where the player releases the ball.
- (ii) Synchronise the two videos at these points.
- (iii) Play the video through and describe five differences between the two passing techniques.
  - *The overhead technique uses two hands to pass the ball.*
  - *The right ankle moves through a wider range of plantar flexion during the javelin pass.*
  - *The ball is thrown from behind the head during the overhead technique.*
  - *Both arms stay extended in front of the player’s body for longer during the overhead technique.*
  - *The player adopts a wider foot position during the javelin pass technique.*

**BLEND – (Quintic Sports, Quintic Coaching and Quintic Biomechanics only)**

**Open the video file ‘Lay - up2 (left)’**

- 8) Set the video zoom to 1.2 and watch the video several times and familiarise yourself with the passing technique.
  - (i) Play and pause the video at frame 50.
  - (ii) Which key point in the action does this represent?  
*Frame 50 shows the athlete taking off from the ground.*

- (iii) 'Set Background' at frame 27 so it can be used in the Blend function.  
(iv) How has the basketball player changed her body shape compared to the background in:

Frame 38?

*The player has continued travelling forwards; the right leg is flexed in front of the player at the point of heel contact and the left leg is extended behind the player in the toe off position.*

Frame 48?

*The player's left hip and knee are in flexion with the left foot completely off the floor, the right leg is extended at the hip and the knee joint, with the ankle in plantar flexion and the foot in a toe off position. The player has now also flexed at the shoulder and elbow joints, bringing the ball above head height.*

Frame 55?

*The player is now completely off the floor, with her right leg extended at the hip and knee below her and the right ankle in plantar flexion. The left leg is flexed at the hip and the knee, with the thigh nearly parallel to the ground. The left arm is in abduction at the shoulder joint and extension at the elbow joint. The right arm is in flexion at both the elbow and the shoulder joint with the right wrist at head height.*

Frame 66?

*The athlete has now rotated approximately 90° from the background position. The athlete is still completely off the floor, with her right leg in extension at the hip and knee joints and the ankle in plantar flexion with left leg is slightly flexed at the and knee joints. The athlete's right shoulder in horizontal abduction and the right elbow in slight flexion. The left arm is in shoulder abduction with the left elbow still in extension.*

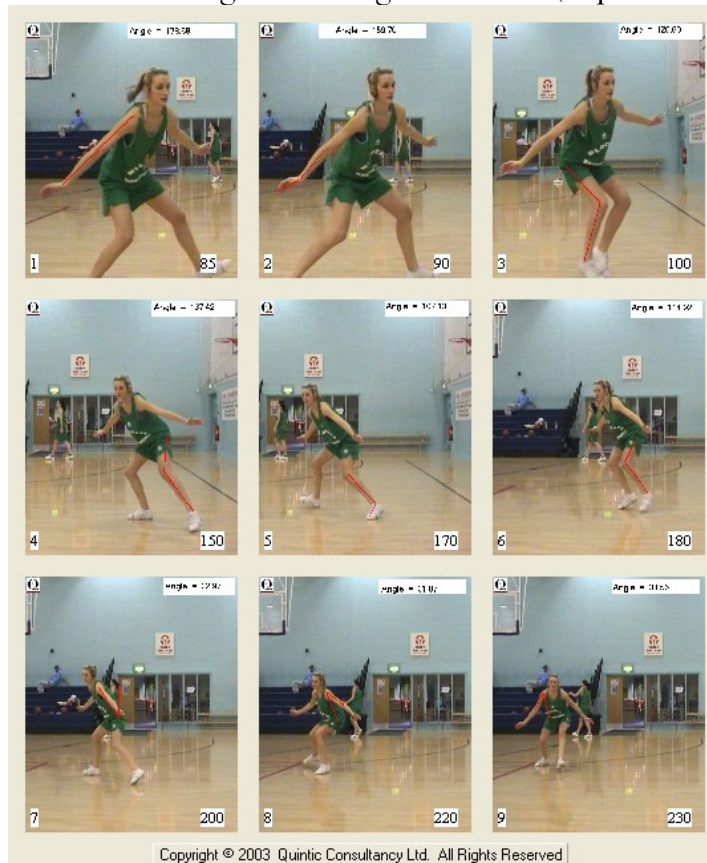
Frame 82?

*The player is now back on the ground with her right ankle in plantar flexion, and with flexed right knee and hip joints. The athlete's left leg is in slight flexion at the hip and knee joints with the ankle being in a neutral position. The left arm is now in a neutral position at the shoulder joint with the elbow in full extension.*

**MULTIPLE – SCREEN IMAGE CAPTURE – (Quintic Sports, Quintic Coaching and Quintic Biomechanics only)**

Open the video file ‘defence2 - fv’  
9)

- (i) Create a 9 frame ‘Multiple Screen Capture’ of the following frames showing the desired angles and a text box showing the angle value.
  - Frame 85 – Angle of the right elbow (shoulder - elbow - wrist)
  - Frame 90 - Angle of right wrist to the horizontal (elbow - wrist)
  - Frame 100 – Angle of right knee (ankle - knee - hip)
  - Frame 150 – Angle of the left knee
  - Frame 170 – Angle of the right ankle (knee – ankle- toe)
  - Frame 180 – angle of the left knee (hip – knee - ankle)
  - Frame 200 – Angle of the left hip to the vertical (shoulder – hip)
  - Frame 220 – Angle of the left shoulder (hip – shoulder - elbow)
  - Frame 230 – angle of the right shoulder ( hip – shoulder – elbow)



- (i) Save this as a JPEG.
- (ii) Open this JPEG in Microsoft Word and give it an appropriate title, including your name.
- (iii) Ask your teacher if you may print this document.

**DIGITISATION – (Quintic Biomechanics only)**

**Open the video file ‘Free throw – SV3’**

- 10) A digitisation template has already been completed for this video, which tracks the right-hand side of the player
- (i) Start a new trace.
  - (ii) Load the digitisation template **basketball.qrm** from the basketball video file.
  - (iii) Complete the digitisation trace for frames 89-127
  - (iv) Save the trace.

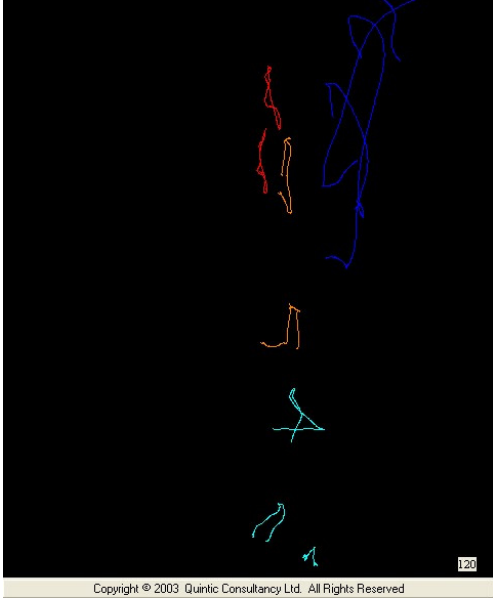
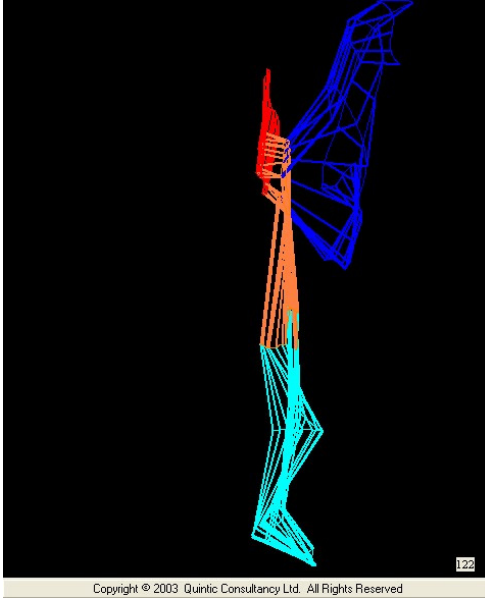
(v) Using the ruler function  , find out the lengths of the following:


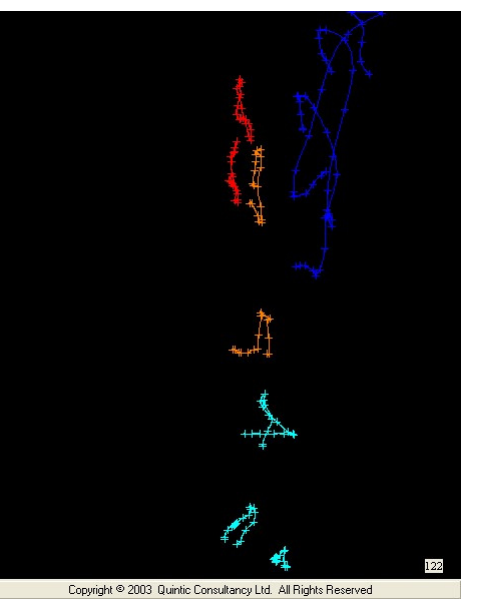
*(Hint: Scroll through the video frames until you see the best angle at which to take your measurement i.e. for the upper-arm measurement, when the shoulder and elbow are clearly visible.)*



| <b>Object</b> | <b>Length (m)</b> |
|---------------|-------------------|
| Forearm       | <i>0.31m</i>      |
| Trunk         | <i>0.77m</i>      |
| Thigh         | <i>0.34</i>       |
| Foot          | <i>0.32m</i>      |
| Head          | <i>0.21m</i>      |

11) Open the animation window.

(i) Which buttons are used in combination to create the following pictures? (Hint: All look at the frame number in the bottom right hand corner of each picture.)

a)  

b)  

c)  

The images show four different screenshots (a, b, c, d) of an animation window. Each screenshot displays a basketball player's movement path in various colors (red, orange, yellow, green, blue) on a black background. The frame number is visible in the bottom right corner of each screenshot. Below each screenshot are two small icons representing the buttons used to create the path. The icons are: a) a wavy line, b) a wavy line and a diagonal line, c) a wavy line and a yellow square with a black figure, d) a wavy line and a plus sign.

12) Open the Analysis window



Select 'Display Graphs', then 'Linear distance, velocity and acceleration'.

Fill in the tables with the correct number of stars to produce the following graphs. Choose 1 star, 2 stars or 0 stars for each box:

- a) Horizontal velocity of all points **without** exact values displayed.  
 Acceleration of the right knee **with** exact values displayed.  
 Velocity of the right ankle **with** exact values displayed.

|                    | Distance | Velocity | Accn | Horizontal Distance | Vertical Distance | Horizontal Velocity | Vertical Velocity | Horizontal Accn | Vertical Accn |
|--------------------|----------|----------|------|---------------------|-------------------|---------------------|-------------------|-----------------|---------------|
| Vertex of Head     |          |          |      |                     |                   | *                   |                   |                 |               |
| 7th Cervical       |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Glenohumeral |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Hip          |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Elbow        |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Wrist        |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Finger       |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Knee         |          |          | **   |                     |                   | *                   |                   |                 |               |
| Right Ankle        |          | **       |      |                     |                   | *                   |                   |                 |               |
| Right Toe          |          |          |      |                     |                   | *                   |                   |                 |               |

- b) Horizontal distance of all points **without** exact values displayed.  
 Vertical velocity of all points **with** exact values displayed.  
 Distance of the 7<sup>th</sup> cervical **with** exact values displayed.

|                    | Distance | Velocity | Accn | Horizontal Distance | Vertical Distance | Horizontal Velocity | Vertical Velocity | Horizontal Accn | Vertical Accn |
|--------------------|----------|----------|------|---------------------|-------------------|---------------------|-------------------|-----------------|---------------|
| Vertex of Head     |          |          |      |                     | *                 |                     | **                |                 |               |
| 7th Cervical       | *        |          |      |                     | *                 |                     | **                |                 |               |
| Right Glenohumeral |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Hip          |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Elbow        |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Wrist        |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Finger       |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Knee         |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Ankle        |          |          |      |                     | *                 |                     | **                |                 |               |
| Right Toe          |          |          |      |                     | *                 |                     | **                |                 |               |

- c) Acceleration of the vertex of the head and right hip **with** exact values displayed.  
 Horizontal velocity of all points **with** exact values displayed.  
 Horizontal distance of the right toe and ankle **with** exact values displayed.

|                    | Distance | Velocity | Accn | Horizontal Distance | Vertical Distance | Horizontal Velocity | Vertical Velocity | Horizontal Accn | Vertical Accn |
|--------------------|----------|----------|------|---------------------|-------------------|---------------------|-------------------|-----------------|---------------|
| Vertex of Head     |          |          | **   |                     |                   | **                  |                   |                 |               |
| 7th Cervical       |          |          |      |                     |                   | **                  |                   |                 |               |
| Right Glenohumeral |          |          |      |                     |                   | **                  |                   |                 |               |
| Right Hip          |          |          | **   |                     |                   | **                  |                   |                 |               |
| Right Elbow        |          |          |      |                     |                   | **                  |                   |                 |               |
| Right Wrist        |          |          |      |                     |                   | **                  |                   |                 |               |
| Right Finger       |          |          |      |                     |                   | **                  |                   |                 |               |
| Right Knee         |          |          |      |                     |                   | **                  |                   |                 |               |
| Right Ankle        |          |          |      | **                  |                   | **                  |                   |                 |               |
| Right Toe          |          |          |      | **                  |                   | **                  |                   |                 |               |

- d) Vertical acceleration of the right wrist **without** exact values displayed.  
 Horizontal velocity of the right toe **without** exact values displayed.  
 Vertical distance of the vertex of the head **with** exact values displayed.

|                    | Distance | Velocity | Accn | Horizontal Distance | Vertical Distance | Horizontal Velocity | Vertical Velocity | Horizontal Accn | Vertical Accn |
|--------------------|----------|----------|------|---------------------|-------------------|---------------------|-------------------|-----------------|---------------|
| Vertex of Head     |          |          |      |                     | **                |                     |                   |                 |               |
| 7th Cervical       |          |          |      |                     |                   |                     |                   |                 |               |
| Right Glenohumeral |          |          |      |                     |                   |                     |                   |                 |               |
| Right Hip          |          |          |      |                     |                   |                     |                   |                 |               |
| Right Elbow        |          |          |      |                     |                   |                     |                   |                 |               |
| Right Wrist        |          |          |      |                     |                   |                     |                   |                 | *             |
| Right Finger       |          |          |      |                     |                   |                     |                   |                 |               |
| Right Knee         |          |          |      |                     |                   |                     |                   |                 |               |
| Right Ankle        |          |          |      |                     |                   | *                   |                   |                 |               |
| Right Toe          |          |          |      |                     |                   |                     |                   |                 |               |

- 13) Open the analysis window and then save the data as an excel file. Open the saved digitisation data in Microsoft Excel and answer the following questions:  
In frame 117, what are the values of:
- (i) Horizontal distance of the knee?  
 **$0.09m$**
  - (ii) Vertical distance of the ankle?  
 **$-0.14m$**
  - (iii) Distance of the hip?  
 **$0.36m$**
  - (iv) Vertical distance of the shoulder?  
 **$-0.25m$**
  - (v) Horizontal distance of the toe?  
 **$0.05m$**
  - (vi) Distance of the toe?  
 **$0.18$**
- 14) Use the 'Graph Display Options' to find the following values 0.46 seconds after the start of digitisation.
- (i) Vertical velocity of the toe?  
 **$-0.301ms^{-1}$**
  - (ii) Vertical acceleration of the ankle?  
 **$103.4ms^{-2}$**
  - (iii) Horizontal distance of the shoulder?  
 **$-0.046m$**
  - (iv) Velocity of the knee?  
 **$0.978ms^{-1}$**
  - (v) Acceleration of the knee?  
 **$-2.335ms^{-2}$**
  - (vi) Horizontal velocity of the hip?  
 **$-0.768ms^{-1}$**
- 15) At frame 101 what are the values of:
- (i) Velocity of the hip?  
 **$0.51ms^{-1}$**
  - (ii) Vertical velocity of the knee?  
 **$-10ms^{-1}$**
  - (iii) Horizontal distance of the ankle?  
 **$0.04m$**
  - (iv) Acceleration of the toe?  
 **$0.61ms^{-2}$**
  - (v) Horizontal acceleration of the shoulder?  
 **$-2.51ms^{-2}$**
  - (vi) Vertical distance of the hip?  
 **$0.01m$**