PE.MA3 Movement Analysis: Planes and Axes of Movement

Total Marks

AQA 8582 · Calculators not allowed · about 50 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Which plane of movement divides the body into left and right sides?

- ☐ A) The sagittal plane
- ☐ B) The frontal plane
- ☐ C) The transverse plane
- ☐ D) The longitudinal plane

(Total for Question 1 is 1 mark)

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2 The human body can move in three planes of movement.

(a) Describe the sagittal plane, and give one sporting example of a movement that takes place within it. **(2)**

(b) Describe the frontal plane, and give one sporting example of a movement that takes place within it. **(2)**

(c) Describe the transverse plane, and give one sporting example of a movement that takes place within it. **(2)**

(Total for Question 2 is 6 marks)

3 Each type of joint movement mainly takes place within one plane of movement.

(a) State the plane of movement in which flexion and extension mainly take place. **(1)**

(b) State the plane of movement in which abduction and adduction mainly take place. **(1)**

(c) State the plane of movement in which rotation mainly takes place. **(1)**

(Total for Question 3 is 3 marks)

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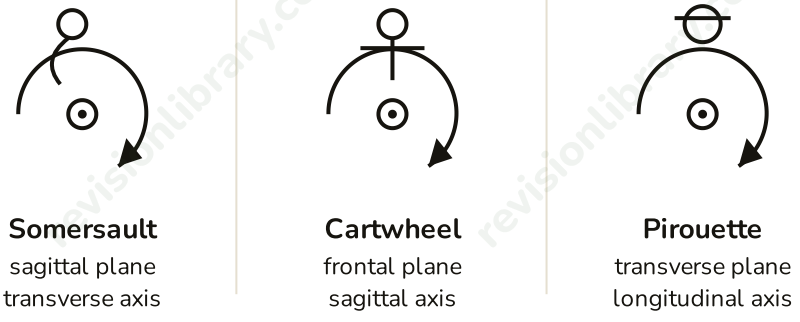
4 Diagram 1 shows three gymnastic/trampolining skills. In each panel, the small circle with a dot marks the axis of rotation viewed end-on (looking straight along the axis), and the curved arrow shows the direction of rotation.



Somersault
sagittal plane
transverse axis

Cartwheel
frontal plane
sagittal axis

Pirouette
transverse plane
longitudinal axis

(a) Name the plane of movement and the axis of rotation shown in the 'Somersault' panel. **(2)**

(b) Name the plane of movement and the axis of rotation shown in the 'Cartwheel' panel. **(2)**

(c) Name the plane of movement and the axis of rotation shown in the 'Pirouette' panel. **(2)**

5 Table 1 describes four sporting movements.

Table 1

Row	Movement description
(a)	A long jumper's body rotates forward over the take-off leg during flight
(b)	A cricket bowler's arm rotates around its own long axis during a doosra delivery
(c)	A gymnast performs a straddle jump, moving both legs out sideways and back together
(d)	A hurdler leans the trunk forward sharply over the lead leg while clearing a hurdle

(a) Identify the plane and axis for row (a). **(1)**

(b) Identify the plane and axis for row (b). **(1)**

(c) Identify the plane and axis for row (c). **(1)**

(d) Identify the plane and axis for row (d). **(1)**

(Total for Question 5 is 4 marks)

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6 A footballer performs a scissor kick, swinging one leg out sideways and up, then back down, without turning the hips.

(Total for Question 6 is 2 marks)

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7 A swimmer performs a forward tumble turn, rotating head-over-heels at the wall before pushing off.

(Total for Question 7 is 2 marks)

8 A trampolinist performs a 'rudolph', a straight forward somersault combined with a full twist about the body's long axis, all completed in a single airborne skill.

(a) Identify the plane and axis used for the somersault component of this skill. **(2)**

(b) Identify the plane and axis used for the twist component of this skill. **(2)**

(c) Explain why this single skill, the rudolph, involves rotation about two different axes at the same time. **(2)**

(Total for Question 8 is 6 marks)

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9 Which axis runs vertically from the head to the toes through the centre of the body?

- ☐ A) The sagittal axis
- ☐ B) The frontal axis
- ☐ C) The longitudinal axis
- ☐ D) The lateral axis

(Total for Question 9 is 1 mark)

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10 State the axis of rotation that corresponds to the frontal plane, and explain why it is described as running front to back through the body.

(Total for Question 10 is 2 marks)

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11 Describe the orientation of the transverse axis through the body, name one sporting skill that rotates about it, and explain what 'perpendicular' means in the relationship between a plane and its axis.

(Total for Question 11 is 3 marks)

12 Priya is a trampolinist who, within a single competition routine, performs a straight forward somersault, a barani (somersault with a half twist) and a full pirouette-style twist skill with no somersault at all.

Discuss how knowledge of planes and axes helps a coach analyse the different skills in Priya's routine, referring to at least two of her named skills, and evaluate why a skill that combines two rotations (such as the barani) is more demanding to analyse than a skill involving only one plane of movement.

(Total for Question 12 is 9 marks)

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13 Which of the following best describes the relationship between a plane of movement and its corresponding axis of rotation?

- ☐ A) The axis is always perpendicular (at a right angle) to the plane in which the movement takes place
- ☐ B) The axis and the plane always point in exactly the same direction
- ☐ C) Every plane shares the same axis of rotation
- ☐ D) The axis only applies to gymnastics and trampolining skills

(Total for Question 13 is 1 mark)

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14 A javelin thrower rotates their trunk rapidly during the delivery stride, twisting the shoulders and hips around the body's own long axis to generate throwing power.

(Total for Question 14 is 2 marks)

15 Explain why it is not enough for a coach to name only the plane of movement, or only the axis of rotation, when analysing a sporting skill, using an example to support your answer.

(Total for Question 15 is 2 marks)

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16 Explain why the ankle joint's plantarflexion and dorsiflexion movements, used for example when a footballer points their toes to strike a ball, take place in the sagittal plane rather than the frontal or transverse plane.

(Total for Question 16 is 2 marks)

Mark scheme · PE.MA3 Movement Analysis: Planes and Axes of Movement

Question 1

- **B1** A
- **Answer: A**

Question 2

- (a) **B1** the sagittal plane divides the body into left and right sides, oe
- (a) **B1** movements such as flexion and extension occur within it, e.g. a forward somersault on a trampoline, oe
- **(a) Answer: The sagittal plane divides the body into left and right sides; flexion and extension movements happen within it, for example a forward somersault on a trampoline.**
- (b) **B1** the frontal plane divides the body into front and back halves, oe
- (b) **B1** movements such as abduction and adduction occur within it, e.g. a star jump/jumping jack, oe
- **(b) Answer: The frontal plane divides the body into front and back halves; abduction and adduction movements happen within it, for example a star jump.**
- (c) **B1** the transverse plane divides the body into upper and lower halves, oe
- (c) **B1** rotational movements occur within it, e.g. a discus thrower spinning through the circle, oe
- **(c) Answer: The transverse plane divides the body into upper and lower halves; rotational movements happen within it, for example a discus thrower spinning through the throwing circle.**

Question 3

- (a) **B1** sagittal plane
- **(a) Answer: Sagittal plane.**
- (b) **B1** frontal plane
- **(b) Answer: Frontal plane.**
- (c) **B1** transverse plane
- **(c) Answer: Transverse plane.**

Question 4

- (a) **B1** sagittal plane
- (a) **B1** transverse axis
- **(a) Answer: Sagittal plane, rotating about the transverse axis.**
- (b) **B1** frontal plane
- (b) **B1** sagittal axis
- **(b) Answer: Frontal plane, rotating about the sagittal axis.**
- (c) **B1** transverse plane
- (c) **B1** longitudinal axis
- **(c) Answer: Transverse plane, rotating about the longitudinal axis.**

Question 5

- (a) **B1** sagittal plane, transverse axis
- **(a) Answer: Sagittal plane, transverse axis.**
- (b) **B1** transverse plane, longitudinal axis
- **(b) Answer: Transverse plane, longitudinal axis.**
- (c) **B1** frontal plane, sagittal axis
- **(c) Answer: Frontal plane, sagittal axis.**
- (d) **B1** sagittal plane, transverse axis
- **(d) Answer: Sagittal plane, transverse axis.**

Question 6

- **B1** frontal plane
- **B1** sagittal axis
- **Answer: Frontal plane, rotating about the sagittal axis.**

Question 7

- **B1** sagittal plane
- **B1** transverse axis
- **Answer: Sagittal plane, rotating about the transverse axis.**

Question 8

- (a) **B1** sagittal plane
- (a) **B1** transverse axis
- **(a) Answer: Sagittal plane, rotating about the transverse axis.**
- (b) **B1** transverse plane
- (b) **B1** longitudinal axis
- **(b) Answer: Transverse plane, rotating about the longitudinal axis.**
- (c) **B1** the somersault is a separate rotation about the transverse axis, in the sagittal plane, oe
- (c) **B1** the twist is a separate, simultaneous rotation about the longitudinal axis, in the transverse plane, so combining the two skills means the body rotates about two different axes, in two different planes, at the same time, oe
- **(c) Answer: The somersault (rotation about the transverse axis, in the sagittal plane) and the twist (rotation about the longitudinal axis, in the transverse plane) are two separate rotations; performing both together means the body rotates about two different axes, and therefore moves in two different planes, at the same time.**

Question 9

- **B1** C
- **Answer: C**

Question 10

- **B1** the sagittal axis
- **B1** each axis of rotation is perpendicular (at a right angle) to its matching plane; since the frontal plane runs left to right and up and down, the axis perpendicular to it must run front to back, oe
- **Answer: The sagittal axis, because each axis of rotation is perpendicular to its matching plane; since the frontal plane runs left to right and up and down, the axis perpendicular to it must run front to back through the body.**

Question 11

- **B1** the transverse axis is a horizontal line running from left to right through the body's centre of mass, oe
- **B1** a correct sporting skill, e.g. a forward somersault, a diving pike entry, oe
- **B1** perpendicular means the axis is at a right angle (90 degrees) to the plane it corresponds to, oe
- **Answer: The transverse axis is a horizontal line running from left to right through the body's centre of mass; a forward somersault rotates about it. Perpendicular means the axis is at a right angle, 90 degrees, to the plane it corresponds to.**

Question 12

- **Level 3** (7-9): A detailed and coherent response that accurately identifies the plane and axis for at least two of Priya's named skills, explains how this knowledge helps a coach analyse technique, and gives a well-justified evaluation of why combined-rotation skills such as the barani are more demanding to analyse. Sustained, accurate use of plane/axis terminology throughout.
- **Level 2** (4-6): Some accurate identification of plane and axis for Priya's skills, with some explanation of its use to a coach, but coverage of two or more skills or the evaluative point about combined-rotation skills may be incomplete or underdeveloped.
- **Level 1** (1-3): Basic or generic statements about planes and axes with little or no application to Priya's specific skills, and little or no evaluation.
- **Level 0** (0): No relevant content.
- **Indicative content:**
  - The straight forward somersault takes place in the sagittal plane, rotating about the transverse axis.
  - The pirouette-style twist takes place in the transverse plane, rotating about the longitudinal axis.
  - The barani combines both: a somersault (sagittal plane, transverse axis) and a twist (transverse plane, longitudinal axis) performed at the same time.
  - Coaching use: naming the correct plane and axis lets a coach describe exactly which body rotation needs coaching (e.g. whether a fault is in the somersault rotation or the twisting rotation), rather than giving vague feedback.
  - Coaching use: understanding planes and axes also helps a coach spot timing faults, such as starting the twist too early or too late relative to the somersault rotation.
  - Evaluative point: a single-plane skill (the straight somersault, or the pure twist) only requires analysing rotation about one axis, which is comparatively simple to observe and coach.
  - Evaluative point: a combined skill such as the barani requires the coach to track two separate rotations, about two different axes, happening simultaneously, which is harder to observe, describe and correct than a single rotation.
  - Balanced conclusion: the more planes and axes involved in a skill, the more separate elements of technique a coach must analyse at once, which is why multi-axis skills are generally considered more technically demanding to learn and to coach.

Question 13

- **B1** A
- **Answer: A**

Question 14

- **B1** transverse plane
- **B1** longitudinal axis
- **Answer: Transverse plane, rotating about the longitudinal axis.**

Question 15

- **B1** the plane describes the direction the body moves in but not what it is rotating around, while the axis describes what it rotates around but not, on its own, which direction of movement that produces, so together they give a complete description, oe
- **B1** example showing the pairing matters, e.g. naming 'transverse plane' alone does not distinguish a discus spin (longitudinal axis) from some other rotation, so the axis must also be stated to fully describe the movement, oe
- **Answer: The plane describes the direction the body moves in, but not what it is rotating around, while the axis describes what it rotates around, but not, alone, which direction of movement that produces; together they give a complete description. For example, naming only 'transverse plane' does not fully describe a discus spin without also stating that it rotates about the longitudinal axis.**

Question 16

- **B1** plantarflexion and dorsiflexion are forms of flexion and extension of the foot at the ankle, oe
- **B1** flexion and extension movements take place in the sagittal plane, so plantarflexion and dorsiflexion, being types of flexion and extension, also take place in the sagittal plane, oe
- **Answer: Plantarflexion and dorsiflexion are forms of flexion and extension of the foot at the ankle; since flexion and extension movements take place in the sagittal plane (Question 3(a)), plantarflexion and dorsiflexion also take place in**