**PRACTICE ASSESSMENT 2**

**Specialist Mathematics: Unit 1 examination**

Unit

Unit 1: Combinatorics, proof, vectors and matrices

Topics

Topic 3: Vectors in the plane

Topic 4: Algebra of vectors in two dimensions

Topic 5: Matrices

Conditions

|  |  |  |
| --- | --- | --- |
| **Response Type** | **Duration** | **Reading** |
| Short response: technology-free and technology active responses from three of the five topics in Unit 1 | 90 minutes | 5 minutes |
| **Resources** | **Instructions** | |
| * QCAA Specialist Mathematics formula book * Notes not permitted * QCAA-approved graphics calculator (no CAS functionality) and/or a handheld QCAA-approved scientific calculator permitted | * Show all working. * Write responses using a black or blue pen. * Unless otherwise instructed, give answers to **two decimal places**. | |

|  |  |  |
| --- | --- | --- |
| **Criterion** | **Marks allocated** | **Result** |
| **Foundational knowledge and problem-solving**  \*Assessment objectives  1. Recall mathematical knowledge.  2. Use mathematical knowledge.  3. Communicate mathematical knowledge.  4. Evaluate the reasonableness of solutions.  5. Justify procedures and decisions.  6. Solve mathematical problems |  |  |

PAPER A: TECH-FREE (NO CALCULATOR)

Topic 3: Vectors in the planeTechnology free

|  |  |
| --- | --- |
| **Question 1 (2 marks) Simple familiar** | |
| Use vectors  and  to represent the following on a diagram: | |
| **Question 2 (4 marks) Simple familiar** |
| Determine the unit vector in the direction of  for the following vectors. Give your answers in Cartesian form. |
| **Question 3 (4 marks) Complex familiar** |
| Let  and , where .  If  and , determine the values of  and . Show your working. |

Topic 4: Algebra of vectors in two dimensionsTechnology free

|  |
| --- |
| **Question 4 (4 marks) Simple familiar** |
| A (–2, –4), B (3, 1) and C (–3, –2) are three points on a plane.   1. Determine the displacement vector . 5i + 5j 2. Determine the displacement vector  in polar form. 3. Calculate. 12i + 6j 4. Calculate . -8i + j |
| **Question 5 (4 marks) Simple familiar** |
| Let  Calculate each of the following dot products.   1. -6 2. 18 3. -27 4. u.(18i - 21j) = -26 |

Topic 5: MatricesTechnology free

|  |  |
| --- | --- |
| **Question 6 (5 marks) Simple familiar** | |
| Consider the matrices  and .   1. Determine the order of matrices  and . M = 3 x 2, N = 2 x 3 2. Identify the element  of matrix  and the element  of matrix . m32 = 3, n21 = -3 3. Explain whether the products and are defined, and if they are, determine the order of the product matrix. MN = 3 x 3, NM = 2 x 2 | |
| **Question 7 (4 marks) Simple familiar** | |
| If  and :   1. calculate  algebraically 2. calculate  algebraically. | |
| **Question 8 (4 marks) Simple familiar** |
| Solve .  Justify the reasonableness of your solution. |
| **Question 9 (5 marks) Complex unfamiliar** |
| Give a condition for the following system of equations to have a solution and solve the system using matrices where  and  are non-zero real numbers.      Evaluate the reasonableness of your answer, using  and . |

PAPER B: TECH-ACTIVE (USE CALCULATOR)

Topic 3: Vectors in the planeTechnology active

|  |  |
| --- | --- |
| **Question 1 (4 marks) Simple familiar** | |
| Consider the vectors  and .   1. Show that the unit vector in the direction of is twice as long as . 2. Determine the direction of vectors and . Give your answers to two decimal places. 3. Show that  and  are perpendicular. | |
| **Question 2 (2 marks) Simple familiar** |
| A pilot flies 260 km south east, and then 300 km west. Determine the net vector displacement in polar form, to two decimal places. |
| **Question 3 (4 marks) Complex familiar** |
| Two bushwalkers start their hike from the same starting point. The first one walks 3.5 km west and then 6.8 km north-east while the second one walks 7 km south-west and then  km east ().  Determine  if the final distance between the two bushwalkers is 6.2 km. Give your answer to one decimal place. Show your working. |

Topic 4: Algebra of vectors in two dimensionsTechnology active

|  |  |
| --- | --- |
| **Question 4 (6 marks) Simple familiar** | |
| Determine the dot product  in each of the following cases. Give your answer to two decimal places where appropriate. | |
| **Question 5 (4 marks) Simple familiar** | |
| Determine the angle  between the positive directions of  and  for each of the following cases. Give your answers in degrees, to two decimal places where appropriate. | |
| **Question 6 (6 marks) Simple familiar** |
| Let . Determine each of the following. Give your answers in exact form.   1. The scalar projection of  on . 2. The vector resolute of  parallel to . 3. The vector resolute of perpendicular to . |

Topic 5: MatricesTechnology active

|  |  |
| --- | --- |
| **Question 7 (3 marks) Simple familiar** | |
| Consider the matrices  and  .   1. Calculate  and . 2. Calculate . 3. Calculate  and . | |
| **Question 8 (3 marks) Simple familiar** | |
| Consider the matrices , and   1. Determine  such that  is a singular matrix. Explain your reasoning. 2. Determine  such that . Explain your reasoning. | |
| **Question 9 (4 marks) Complex familiar** |
| An international video game competition with 60 000 players has three lobbies, A, B, and C, available to players. Players can move between lobbies at the end of each round. At the end of each round, the following movements of players between lobbies is observed:   * among the players in lobby A, 30% move to lobby B, 30% move to lobby C, and 40% remain in lobby A * among the players in lobby B, 20 % move to lobby A, 20% move to lobby C and 60% remain in lobby B * among the players in lobby C, 10% move to lobby A, 40% move to lobby B, and 50% remain in lobby C.  1. At the start of a competition with 60 000 players, 20 000 players in lobby A, 30 000 in lobby B, and 10 000 in lobby C. 2. Determine the number of players in each level after two rounds.  Using technology, determine whether the repartition of players between lobbies stabilises. |

Examination marks summary - **DRAFT**

This is draft – it is from the actual test.

Likely less simple familiar questions (reduction of part-questions)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Question | Simple familiar | Complex familiar | Complex unfamiliar | Question | Simple familiar | Complex familiar | Complex unfamiliar |
| **1** | 2 |  |  | **2** | 2 |  |  |
| **2** | 4 |  |  | **3** | 4 |  |  |
| **5** |  | 4 |  | **4** |  | 4 |  |
| **1** | 5 |  |  | **1** | 4 |  |  |
| **3** | 3 |  |  | **2** | 4 |  |  |
| **1** | 3 |  |  | **3** | 4 |  |  |
| **2** | 3 |  |  | **1** | 6 |  |  |
| **3** | 4 |  |  | **3** | 3 |  |  |
| **5** |  |  | 5 | **4** |  |  | 6 |
| TOTALS | 24 | 4 | 5 |  | 27 | 4 | 6 |
|  |  |  |  |  |  |  |  |
| Percentages | 73% | 12% | 15% |  | 73% | 11% | 16% |