**West Coast Collaborative**

**Specialist Mathematics Units 3 & 4**

**Test 3 2018**

**Calculator Free Section**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_ / 22**

**Time Allowed**: 22 minutes

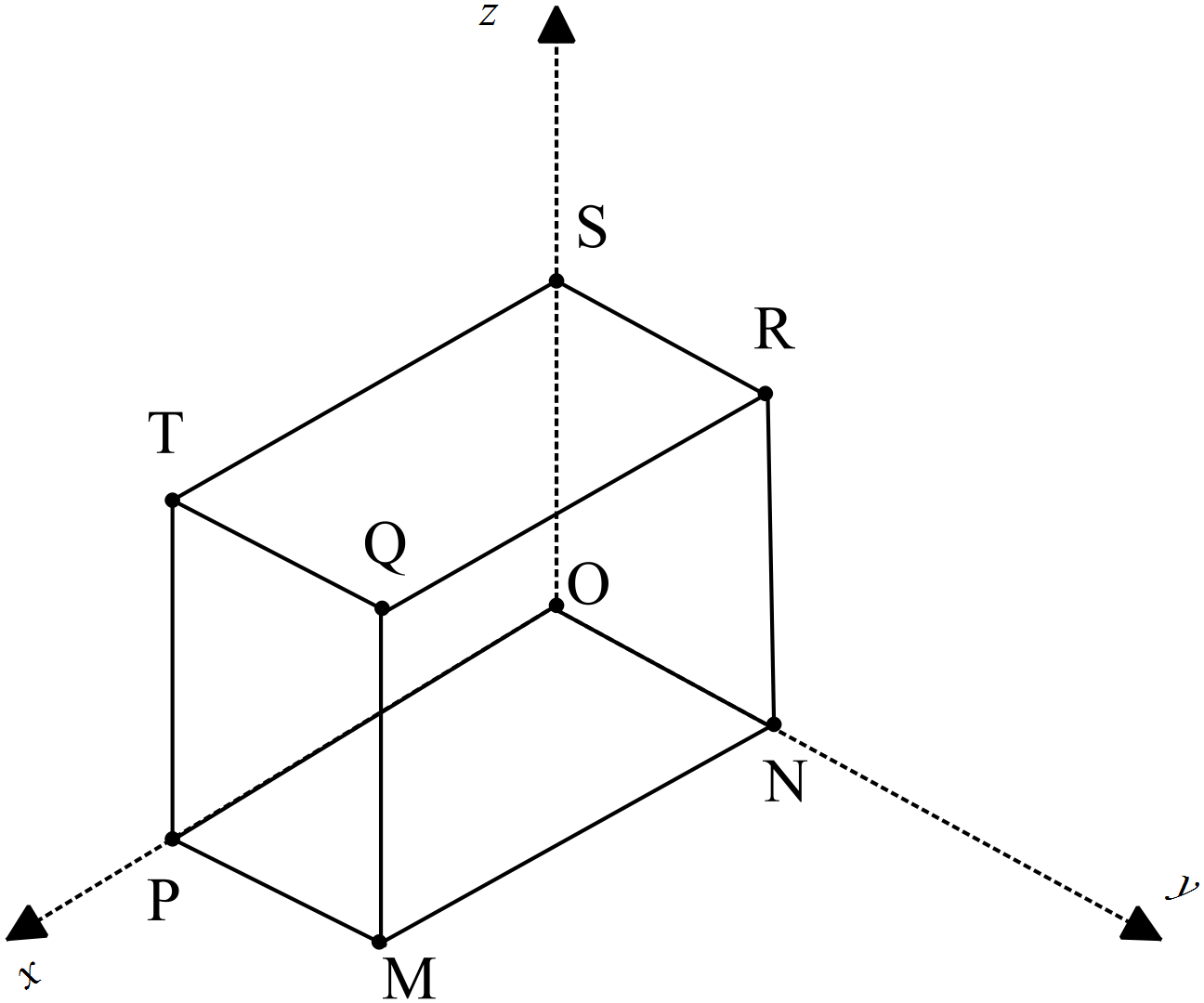
**No calculators or notes are to be used.**

**Access to approved Mathematics Specialist formulae sheet is permitted.**

Where a question or part of a question is worth more than 2 marks sufficient working to justify your solution is required.

**1. [ 4 marks ]**

MNOPQRST is a rectangular prism with **OP = *p***, **ON = *n* and OS = *s*.**



**O** is the origin of the ***x***-***y***-***z*** axes.

Use the fact that and **to** prove that the volume of the cuboid is

**2.** **[ 5,1 = 6 marks]**

A plane Γ contains the points P at position **k –** 2**j,** Q at 4**i** + **j** +3**k** and R at 2**k** – **i.**

**a)** Determine a vector equation which contains the normal to the plane.

**b)** Express this as a Cartesian equation.

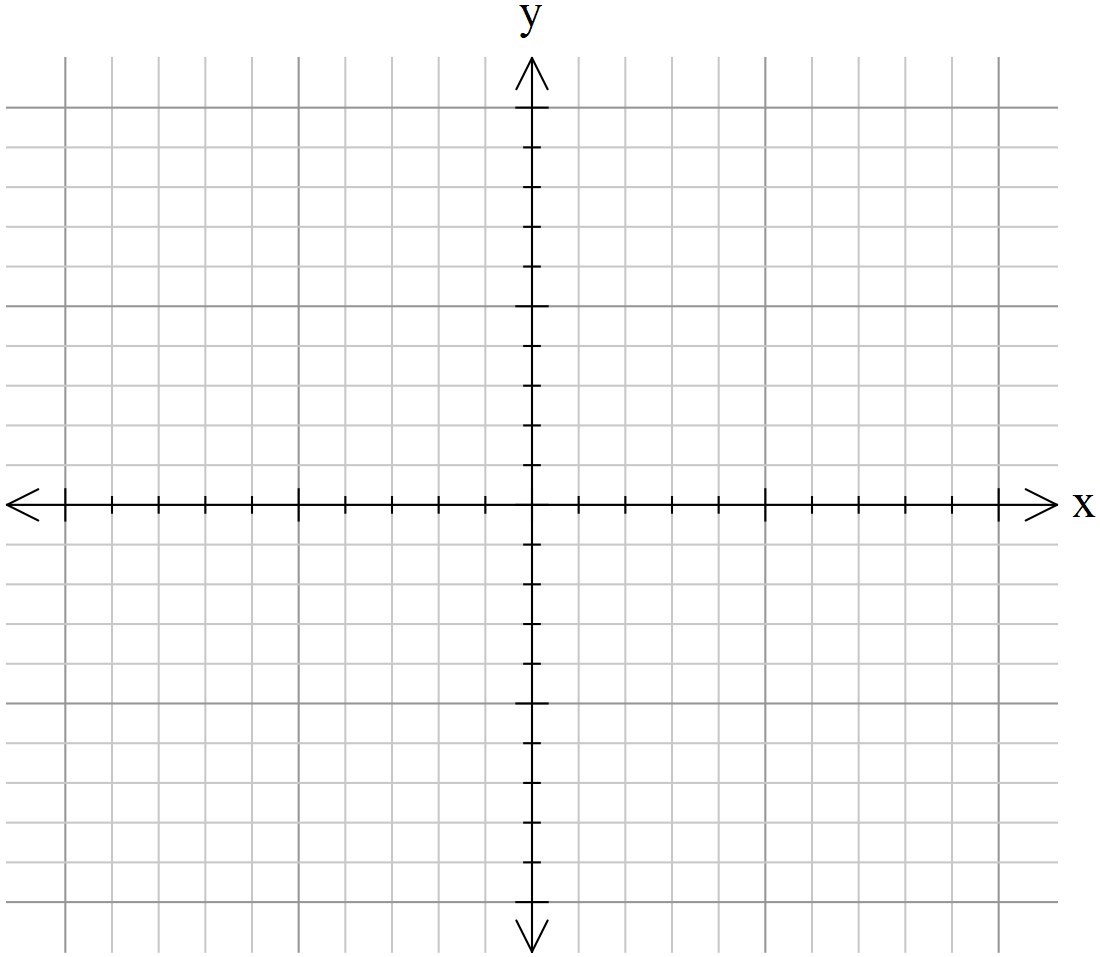
**3. [1, 1, 3 = 5 marks ]**

A point P moves in a path according to the parametric equations: where

1. State the Cartesian equation of the path

1. State the velocity vector of the ellipse

1. Draw the path traced by P on the graph, indicating its direction and key points clearly.



**4. [4, 1, 2 = 7marks]**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x | + | 3y | - | z | = | 5 |
| 2x | + | 7y | - | 3z | = | 6 |
| -x | - | y | + | (p2-p-1)z | = | p-13 |

For what value of p will the above system of equations have:

1. an infinite number of solutions,
2. no solutions
3. a unique solution?

**END OF PAPER**

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**Test 3 2018**

**Calculator Assumed Section**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_ / 33**

**Time Allowed**: 33 minutes **Total Marks**: 33

**Materials Allowed**: SCSA formula booklet, SCSA approved calculators and one A4 page of notes (both sides).

**Instructions:** Where a question or part of a question is worth more than 2 marks sufficient working to justify your solution is required.

5. [1,1,3,4 = 9 marks ]

The Cartesian equation of plane ∏ is .

**a)** State a vector equation of this plane.

The parametric equations of line  are .

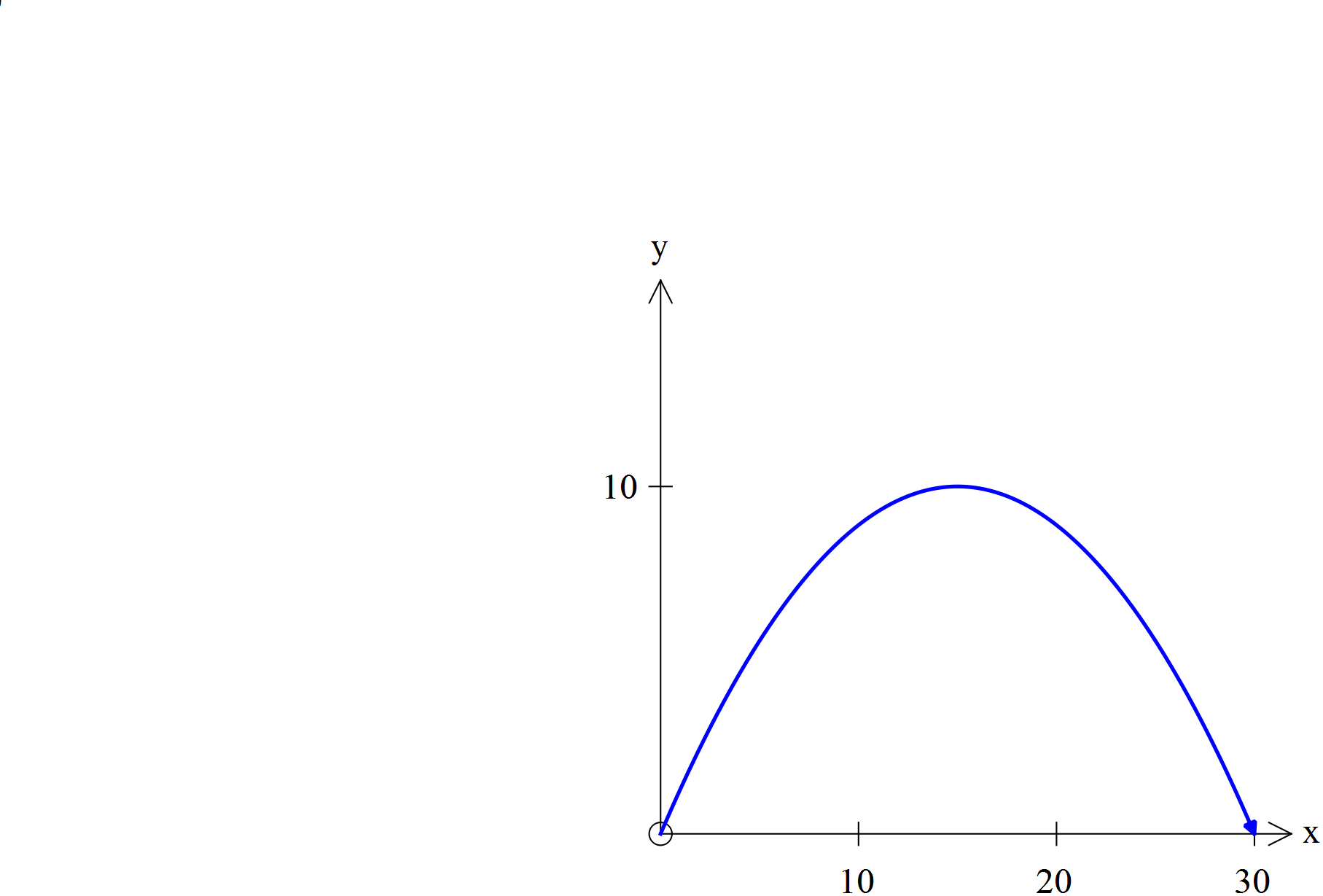
**b)** State a vector equation for line .

**c)** Determine the position vector of , the point of intersection of line  and the plane.

**d)** Determine the acute angle between Line L and plane ∏ to the nearest tenth of a degree.

6. [ 5,3,4 = 12 marks]

For a particle projected from the Origin with speed µ ms-1 at an angle of with the positive x-axis, the position vector at time seconds is metres. The equation of the path of the particle is given by



The diagram featured shows the path of the particle.

The equation of the path of P is .

**a)** State the position vector of P at time seconds.

**b)** Use vector methods to find the direction of the particle at time seconds .

**c)** Use vector methods to find the distance travelled by P along its path, from the time of the projection to the time it hits the -axis again. Show clearly how you obtained your answer.

**7.** **[ 4 marks ]**

Prove that the line ***r*** = is a tangent to the sphere with equation (x-2)2+(y-1)2+(z+1)2 = 10.

**8. [ 2,2,2,2= 8 marks ]**

Three particles A, B & C are such that their initial positions relative to the Origin at a given time are < 0, -1, -2> m ,

< 4, 1, 6 > m and < -4, 1, -2> m respectively. Their constant velocities are < 1, 2, 2 >ms-1, < -1, α, -2 > ms-1 and

< 3, 1, β >ms-1 , also respectively.

**a)** State the position vectors of each particle after *t*  seconds

**b)** If these velocities are maintained all three will collide. Use vector methods to determine the values of α and β.

**c)** If these velocities are maintained only A and B will collide. Use vector methods to determine the possible values of α and β in this instance.

**d)** If these velocities are maintained only two of the three will collide. Use vector methods to determine the possible values of α and β in this instance.

END OF TEST