Started on	Thursday, 3 June 2021, 8:10 AM
State	Finished
Completed on	Thursday, 3 June 2021, 9:45 AM
Time taken	1 hour 34 mins
Grade	**4.25** out of 10.00 (**43**%)

Question **1**

Not answered

Marked out of 2.50

(a) **(0.75p)** Consider the surface:

$$\mathcal{S}_1:\ z = x^2 + y^2$$

Find the points (x_0, y_0, z_0) on the surface $\mathcal{S}_1$ for which the tangent plane $T_{\mathcal{S}}(x_0, y_0, z_0)$ is parallel to the vector $\overrightarrow{v}(1, -1, 0)$ (they form a locus).

(b) **(1p)** Let $\mathcal{S}_2$ be the conoidal surface whose generatrices intersect the line:

$$\ell:\ \frac{x-2}{2} = \frac{y-1}{1} = \frac{z-3}{3}$$

and are parallel to the plane:

$$\pi:\ x + z = 0$$

A director curve of this conoidal surface is given by the equations:

$$\mathcal{C}:\ x = 0; \quad z = x^2 + y^2$$

Find the implicit equation of the surface $\mathcal{S}_2$.

(c) **(0.75p)** Find the coordinates of a point (of your own choosing) which is on the surface $\mathcal{S}_2$, but not on the plane π.

Write the equation of the normal line to $\mathcal{S}_2$ in that point.

The full solution to this exercise must be written by hand and uploaded as a single PDF file to the assignment "Final_exam uploads".

Do not write anything in the textbox below, it will not be taken into consideration.

Question **2**

Incorrect

Mark 0.00 out of 1.00

Let $\mathcal{S}$ be a cylindrical surface whose generatrices are parallel to the vector $(8, 2, 3)$ and whose director curve $\mathcal{C}$ is given by the equations:

$$x^2 + y^2 - z^2 = 1$$

$$y = 0$$

Find its implicit equation. The intersection between the surface $\mathcal{S}$ and the Oy axis consists of two points A and B. Find the absolute value of each of their y-coordinates (it is supposed to be the same).

Answer: 0.250 ✖

The correct answer is: 0.27

Question **3**

Correct

Mark 1.00 out of 1.00

We consider the affine transformation:

$$\phi = R_{\frac{3\pi}{2}} \circ \mathrm{Sh}((\frac{3}{5}, \frac{4}{5}), 5) \circ T(4, 2) \circ R_{\frac{\pi}{2}}$$

and the point $P = (3, 1)$.

Let $Q = \phi(P) = (x_Q, y_Q)$. Find $x_Q + y_Q$.

Answer: 2.600 ✔

The correct answer is: 2.60

Question **4**

Correct

Mark 0.25 out of 0.25

The determinant of the homogeneous matrix of a shear can be negative.

Select one:

- True
- False ✔

The correct answer is 'False'.

Question **5**

Correct

Mark 1.00 out of 1.00

Consider the surface $\mathcal{S}$, given by the implicit equation:

$$\mathcal{S}:\ x^{-7}+y^3+z^4+xy+y^2z-5=0$$

and the curve $\mathcal{C}$, given by the implicit equations:

$$\mathcal{C}:\ x=t^4+6,\ y=t^4+t+4,\ z=t+2$$

Let π be the tangent plane to the surface $\mathcal{S}$ in the point $(1,1,1)$ and take P to be the intersection point between π and $\mathcal{C}$. Write the z-coordinate of P.

Answer: 2.636 ✔

The correct answer is: 2.64

Question **6**

Correct

Mark 0.25 out of 0.25

The generatrices of a cylindrical surface are parallel.

Select one:

- True ✔
- False

The correct answer is 'True'.

Question **7**

Correct

Mark 1.00 out of 1.00

Consider the conic $Q_1: y^2=12x$ and let F be its focus.

Consider now the conic $Q_2: \frac{x^2}{16}-\frac{y^2}{25}=1$

Find the tangents to the conic Q_2 through the point F. The answer to this question will be the modulus of their slope.

(Be careful, F is not necessarily on Q_2!)

Answer: 1.889 ✔

The correct answer is: 1.89

Question **8**

Incorrect

Mark 0.00 out of 0.25

The equation of the tangent plane to the quadric

$$\mathcal{Q}: \frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}-2x=1$$

at its point $M_0(x_0,y_0,z_0)\in\mathcal{Q}$ is:

$$T_{(x_0,y_0,z_0)}(\mathcal{Q}): \frac{x_0x}{a^2}+\frac{y_0y}{b^2}+\frac{z_0z}{c^2}-x-x_0=1$$

Select one:

- True ✖
- False

The correct answer is 'False'.

Question **9**

Incorrect

Mark 0.00 out of 1.00

Consider the quadric:

$$\mathcal{Q}: \frac{x^2}{16}-\frac{y^2}{16}-3z=0$$

Find the two rectilinear generatrices ℓ_1 and ℓ_2 that are perpendicular to the line:

$$\ell: \frac{x-2}{4}=\frac{y}{4}=\frac{z+1}{16}$$

If θ is the acute angle between ℓ_1 and ℓ_2, write the value of $\cos(\theta)$.

Answer: 1.570 ✖

The correct answer is: 0.00

Question **10**

Not answered

Marked out of 1.00

This is not a question. It's here just so your free point can get added correctly.

Question **11**

Correct

Mark 0.25 out of 0.25

A hyperboloid of one sheet is symmetrical with respect to the coordinate planes.

Select one:

- True ✔
- False

The correct answer is 'True'.

Question **12**

Correct

Mark 0.25 out of 0.25

Every reflection with respect to a line through the origin is a linear transformation.

Select one:

- True ✔
- False

The correct answer is 'True'.

Question **13**

Correct

Mark 0.25 out of 0.25

What type of conic is the following curve?

$$\mathcal{C}: \ -\frac{x^2}{4}+\frac{y^2}{9}=2$$

- Ellipse
- Hyperbola ✔
- Parabola

Your answer is correct.

The correct answer is:
Hyperbola

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