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sandipan_dey ~

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* Course / Review / Practice exam (untimed, with solutions)



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11(a)

1/1 point (ungraded)

Find the equation for the tangent plane to the level surface

$$f(x, y, z) = xy^2 + xz - y + 3z = 8$$

at the point (1, 1, 2).

(Enter in the format a*x+b*y+c*z+d=0). The = 0 is provided for you! Do not type it.)

=0 **✓ Answer:** 3*x+y+4*z-12 3*x+y+4*z-12

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Solution:

$$\nabla f = \begin{pmatrix} y^2 + z \\ 2xy - 1 \\ x + 3 \end{pmatrix} \tag{7.2}$$

$$\nabla f = \begin{pmatrix} y^2 + z \\ 2xy - 1 \\ x + 3 \end{pmatrix}$$

$$\nabla f(1, 1, 2) = \begin{pmatrix} 3 \\ 1 \\ 4 \end{pmatrix}$$
(7.2)

The tangent plane equation is

$$3x + y + 4z + d = 0$$

We solve for d by plugging in the point (1,1,2), which gives d=-12.

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1 Answers are displayed within the problem

11(b)

2.0/2 points (ungraded)

Find the time(s) $m{t}$ when the parametric curve

$$ec{r}\left(t
ight)=\left(egin{array}{c} t\ t^2-2\ -t+3 \end{array}
ight)$$

intersects the tangent plane above.

(For more than one time, separate answers by commas: e.g. 0, 1, 2)

✓ Answer: 2,-1 -1,2

Find the speed of the parametric curve at that(those) time(s).





(For more than one speed, separate answers by commas: e.g. 0, 1, 2).

✓ Answer: sqrt(6),sqrt(18) sqrt(6),3*sqrt(2)

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Solution:

We plug in the formula for the parametric curve into the equation for the tangent plane found in the previous problem.

$$3(t) + t^2 - 2 + 4(-t + 3) - 12 = 0 (7.4)$$

$$t^2 - t - 2 = 0 (7.5)$$

$$t^{2} - t - 2 = 0$$

$$(t - 2)(t + 1) = 0$$
(7.5)

Therefore the parametric curve intersects the plane when t=-1 and t=2.

The velocity of the parametric curve is the vector

$$ec{r}'\left(t
ight)=\left(egin{array}{c}1\2t\-1\end{array}
ight)$$

The speed is the magnitude of this vector. When t=-1, the speed is $\sqrt{6}$. When t=2, the speed is $\sqrt{18}$.

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11. Practice Exam

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