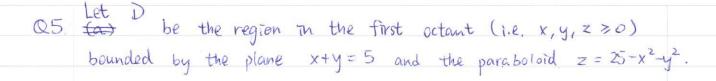
Study Rules: Do revision first.	
Do exercise first.	
When you start, start a timer and a stopwatch; switch	
	true
the colour of your pen once I you finish the paper first or I the stopwatch cange rings	v
For 1, do it until the stopwatch rings & see how many	
more marks you get from the second colour.	
For @, once you finish the paper, stop the timer & see.	
how much more time you need => how munch you	
need to speed up	
V.	
keep exercise yourself & get imp	roved.
P.S. If you took do wish to have the mock paper,	
1. Let 2 == then you should be reminded not to roll down to the	
solution before finishing all the above steps it.	
Get everything ready before turning to the next page.	
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- Q1. Let $\vec{u} = 5\vec{i} + 0\vec{j} 2\vec{k}$ and $\vec{v} = 4\vec{i} + 3\vec{j} + 0\vec{k}$.

 Compute $\vec{u} \cdot \vec{v}$ and $\vec{u} \times \vec{v}$.
- Q2. Let $\vec{r}(t) = e^{-3t}\vec{i} + \cos 2t\vec{j} + (\sin t t^3)\vec{k}$. Find the equation of the tangent line at t=0.
- Q3. Let $\vec{F} = (x + \cos z)\vec{i} + (y + ze^x)\vec{j} + (\cos 2y)\vec{k}$.
 - (a) Compute V. F and VxF.
 - (b) Let S be the closed surface of a solid region bounded by z=2, above by z=2, bounded below by z=0 and bounded laterally by the cylinder $x^2+y^2=\frac{1}{2}$.

 Using (a) and an appropriate theorem, or otherwise, evaluate the flux $\iint_S \vec{F} \cdot \vec{n} \ d\sigma$ where $\vec{F}(x,y,z) = (x+\cos z)\vec{i} + (y+ze^x)\vec{j} + (\cos 2y)\vec{k}$.

 and \vec{n} is the runt outward normal DN S.
- Q4. (a) Find a parametrization of the cone $z = 3\sqrt{x^2 + y^2}$, i.e. find a term vector-valued function which has two variables that traces out the surface of the given cone.
 - (b) Using (a), or otherwise, find the surface area of the cone $z=3\sqrt{x^2+y^2}$. between the planes z=3 and z=6.



(a) Write down a triple integral to determine the volume of the region D by filling in the limits of the integrals.

- (b) Evaluate the above integral.
- Q6. Consider the function $f(x,y) = 4x^3 + 6y^2 3xy 7$.
 - (a) Find all the critical points of this function.
 - (b) Find the relative maximum, relative minimum and saddle points of the function, if any.
- Q7. (a) Determine if the following vector fields are conservative. If so, find a potential of the vector field. $\vec{E} = (6x^2y e^{2y}\cos x)\vec{i} + 2e^y\sin x \vec{j}.$ $\vec{F} = (6x^2y e^{2y}\cos x)\vec{i} + 2(x^3 + e^{2y}\sin x)\vec{j}.$
 - (b) Let C, be the upper half unit circle centered at (0,0) lying on the xy-plane oriented in the counterclockwise direction from (1,0) to (-1,0).

 Evaluate $\int_C \vec{G} \ d\vec{r}$ where $\vec{G}(x,y) = x^3 \vec{J}$.

- Q7 (cont'd) (c) Using (a) and (b), or otherwise, calculate the line integral \int_C , \overrightarrow{E} $\overrightarrow{dr'}$ where $\overrightarrow{E'}(x,y) = (6x^2y e^{2y}\cos x)\overrightarrow{i} + 2e^{2y}\sin x$
 - and C_1 is the upper half unit circle centered at (0,0) lying on the xy-plane oriented in the counterclockwise direction from (1,0) to (-1,0).
 - (d) Using the Green's theorem, or strenuise, evaluate $\int_{C_2} \vec{G} \, d\vec{r}$ where $\vec{G}(x,y) = x^3 \vec{j}$ and C_2 is the unit circle centered at (0,0) lying on the xy-plane oriented in the counterclockwise direction.
 - (e) Let S be the portion of the paraboloid where $z=1-x^2-y^2$ which lies above the xy-plane with unit normal \vec{n} pointing upward. Using (a) and (d), or otherwise, compute $\iint_S (\nabla \times \vec{H}) \cdot \vec{n} \ d\sigma = \iint_S (\text{curl } \vec{H}) \cdot \vec{n} \ d\sigma$ where $\vec{H}(x,y,z) = (6x^2y e^{2y}\cos x)\vec{i} + 2(e^y \sin x + \cos z)\vec{j} + z^2\vec{k}$