Double Integrals in Polar Coordinates

For problems 1 & 2 evaluate the integral over the given region.

1. $\iint_D 6x^2 y\,dA$, *D* is the region between $x^2+y^2=9$ and $x^2+y^2=25$ and to the left of the *y*-axis.

2. $\iint_D \mathbf{e}^{1-3x^2-3y^2}\,dA$, *D* is the disk of radius 6 centered at the origin.

3. Find the volume of the solid that is bounded by $y=16-x^2-z^2$ and $y=2x^2+2z^2-32$. Note that you will have to use a *modified* version of polar coordinates to do this problem.

4. Use a double integral to derive the formula for the area of a circle of radius *a*.

5. Evaluate $\int_{-3}^{0}\int_{0}^{\sqrt{9-x^2}} \cos\left(2x^2+2y^2\right)dy\,dx$ by converting the integral into polar coordinates.

Triple Integrals

For problems 6 – 9 evaluate the given integral.

6. $\int_1^2\int_{y^{-1}}^{0}\int_0^6 x^2 z\sin\left(\frac{2}{y}\right)dx\,dz\,dy$

7. $\iiint_E 3-12z\,dV$ where *E* is the solid bounded by the planes $x+2y+2z=6$, $x=0$, $y=0$, and $z=0$. In other words *E* is the solid that lies beneath $2x+y+3z=6$ and in the first octant.

8. $\iiint_E y\,dV$ where *E* is the solid that lies between $x+2y+2z=6$ and $2x+4y+4z=20$ and is in front of the triangle in the *yz*-plane with vertices (0,0), (1,0) and (1,2) – these are in the form (*y*,*z*).

9. $\iiint_E \sqrt{y^2+z^2}\,dV$ where *E* is the solid that is in front of $x=4y^2+4z^2-3$ and behind $x=1$.

10. Use a triple integral to find the volume of the solid *E* used in problem 8.

Triple Integrals with Cylindrical Coordinates

For problems 11 – 13 you must use cylindrical coordinates to do the problem.

11. $\iiint_E y\,dV$ where *E* is the solid that lies inside $x^2+y^2=9$, above $z=-\frac{1}{2}x^2-\frac{1}{2}y^2$ and below $z=\sqrt{x^2+y^2}$

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12. Find the volume of the solid *E* that is bounded by $y = x^2 + z^2 - 6$ and $y = 9 - 2x^2 - 2z^2$.

13. Use a triple integral to find a formula for the volume of a cylinder of radius *a* and height *h*.