Multivariable Calculus 12.3-13.2 | due 9/20/20

12.4

1. $\begin{vmatrix} 1 & 2 \\ 4 & 3 \end{vmatrix} = 3 - 8 = \boxed{-5}$

5. $\begin{vmatrix} 1 & 2 & 1 \\ 4 & -3 & 0 \\ 1 & 0 & 1 \end{vmatrix} = -3 - (8-3) = \boxed{-8}$

13. $(i+j) \times k = i \times k + j \times k = \boxed{-j+i}$

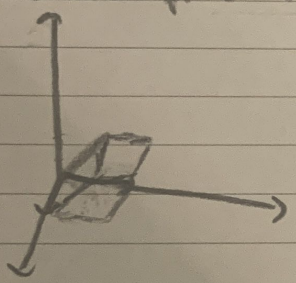
21. $(u-2v) \times (u+2v) = 4(u \times v) = 4\langle 1,1,0 \rangle = \boxed{\langle 4,4,0 \rangle}$

25. Using right hand rule, $-u$ is equal to $v \times w$

27. $v = \langle 3,0,0 \rangle$ $w = \langle 0,1,-1 \rangle \rightarrow v \times w = (|v||w| \sin\theta)n$ $\theta = \cos^{-1}\left(\frac{v \cdot w}{|v||w|}\right) = 90$

$v \times w = |3||\sqrt{2}| \sin 90\, n \rightarrow 3\sqrt{2}\, n \rightarrow 3\sqrt{2}\left(0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) = \boxed{\langle 0,3,3 \rangle}$

39. Sketch and compute V of parallelpiped $u = \langle 1,0,0 \rangle$ $v = \langle 0,2,0 \rangle$, $w = \langle 1,1,2 \rangle$



$|(u \times w) \cdot v|$

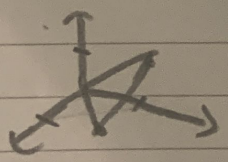
$|(\langle 1,0,0 \rangle \times \langle 1,1,2 \rangle) \cdot \langle 0,2,0 \rangle|$

$\boxed{V = 4}$

41. Find area $u = \langle 1,0,3 \rangle$ $v = \langle 2,1,1 \rangle \rightarrow \theta = \cos^{-1}\left(\frac{u \cdot v}{|u||v|}\right) = 49.8°$

$|u||v| \sin\theta = A = \sqrt{10}\sqrt{6} \sin 49.8 = \boxed{5.92}$

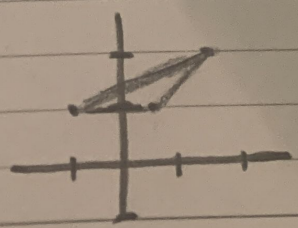
43. Find area, $O(0,0,0)$ $P(3,3,0)$ $Q(0,3,3)$



$A = \frac{1}{2}|OP \times OQ|$

$= \frac{1}{2}|\langle 3,3,0 \rangle \times \langle 0,3,3 \rangle| = \frac{1}{2} 9\sqrt{3} = \boxed{7.8}$

45. Find area $(1,2), (3,4), (-2,2)$



$|\langle 2,2 \rangle \times \langle -3,0 \rangle| = 6 \,/\, 2 = \boxed{3}$

12.5

1. $x+3y+2z=d \quad (4,-1,1) \rightarrow \boxed{x+3y+2z=3}$

5. $x=d \quad (3,1,-4) \rightarrow \boxed{x=3}$

9. $\langle 0,1,0\rangle \quad (0,0,0) \rightarrow \boxed{x=0}$ 11. B and D

13. $9x-4y-11z=2 \quad \boxed{\langle 9,-4,-11\rangle}$

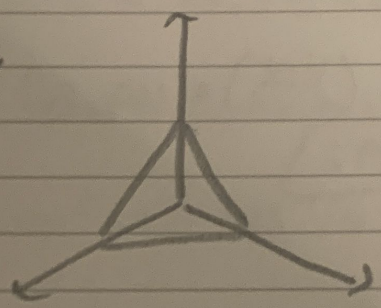
15. $3(x-4)-8(y-1)+11z=0 \rightarrow 3x-8y+11z=4 \rightarrow \boxed{\langle 3,-8,11\rangle}$

17. $P(2,-1,4)\ Q(1,1,1)\ R(3,1,-2)$
$\overline{PQ}=\langle -1,2,-3\rangle \quad \overline{PR}=\langle 1,2,-6\rangle$
$|\overline{PQ}\times\overline{PR}|=\langle -6,-9,-4\rangle \rightarrow \boxed{6x+9y+4z=19}$

19. $P(1,0,0)\ Q(0,1,1)\ R(2,0,1) \quad \overline{PQ}=\langle -1,1,1\rangle \quad \overline{PR}=\langle 1,0,1\rangle$
$|\overline{PQ}\times\overline{PR}|=\langle 1,2,-1\rangle \rightarrow \boxed{x+2y-z=1}$

25. $i+k$ and $(-2,-3,5) \rightarrow \boxed{x+z=3}$

31.



53. $(32)x+by+(22)z=52$
$z\neq 0$

13.1

5. $P=(3,-5,7) \quad v=\langle 3,0,1\rangle \rightarrow \boxed{(3,-5,7)+t\langle 3,0,1\rangle}$

17. $r(t)=(9\cos t)i+(9\sin t)j$
radius $=9$
center $=(0,0,0)$
plane $=$ xy-plane

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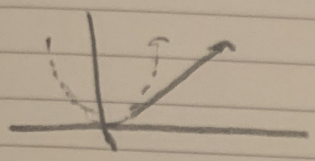
13.2

3. $\lim_{t\to 0} e^{2t}\,i + \ln(t+1)\,j + 4k \rightarrow \boxed{i + 4k}$

5. $\lim_{h\to 0} \frac{r(t+h) - r(t)}{h}$ for $r(t) = \langle t^{-1}, \sin t, 4\rangle \rightarrow \boxed{\langle -t^{-2}, \cos t, 0\rangle}$

7. $r(t) = \langle t, t^2, t^3\rangle \rightarrow \boxed{\langle 1, 2t, 3t^2\rangle}$

15.



31. $r(t) = \langle 1 - t^2, 5t, 2t^3\rangle \quad t = 2$

$r'(t) = \langle -2t, 5, 6t^2\rangle$

$\langle -3 - 4t, 10 + 5t, 16 + 24t\rangle$

41. $\int_{-2}^{2} (u^3 i + u^5 j)\,du \rightarrow \frac{1}{4}u^4 i + \frac{1}{6}u^6 j \Big|_{-2}^{2} = \boxed{\langle 0, 0\rangle}$

49. $r'(t) = t^2 i + 5t j + k \quad r(1) = j + 2k$

In Cond. $r(t) = \langle \frac{1}{3}t^3, \frac{5}{2}t^2, t\rangle + C$

With $r(1)$. $r(t) = \langle \frac{1}{3}t^3 - \frac{1}{3}, \frac{5}{2}t^2 - \frac{3}{2}, t + 1\rangle$