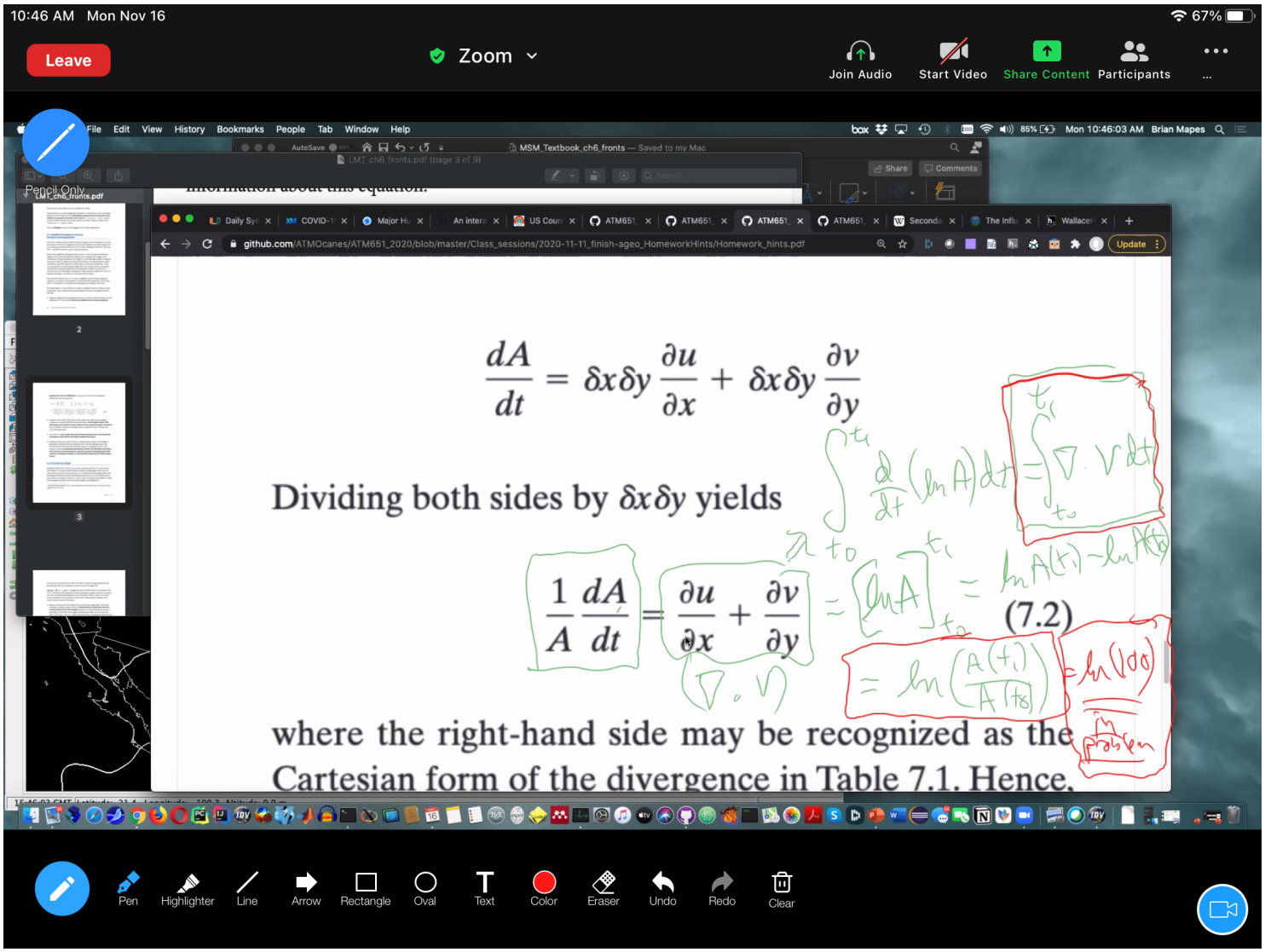
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github.com/ATMOcanes/ATM651_2020/blob/master/Class_sessions/2020-11-11_finish-ageo_HomeworkHints/Homework_hints.pdf
$$\frac{dA}{dt} = \delta x \delta y \frac{\partial u}{\partial x} + \delta x \delta y \frac{\partial v}{\partial y}$$
Dividing both sides by $\delta x \delta y$ yields
$$\frac{1}{A}\frac{dA}{dt} = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} \quad (7.2)$$
where the right-hand side may be recognized as the
Cartesian form of the divergence in Table 7.1. Hence,
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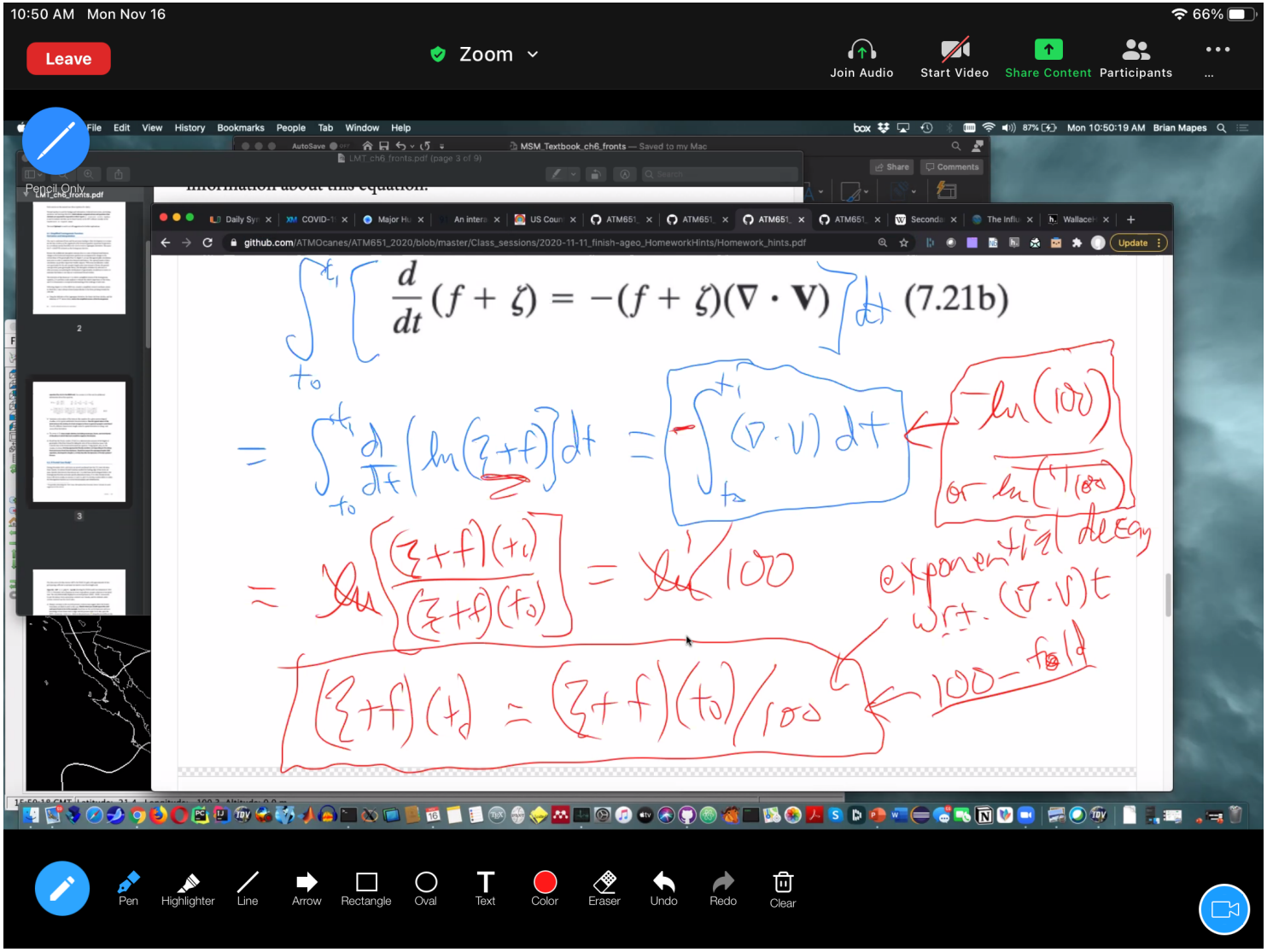
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$\frac{d}{dt}(f+\zeta) = -(f+\zeta)(\nabla \cdot \mathbf{V})$ (7.21b)
exponential decay
w.r.t. $(\nabla \cdot V)t$
100-fold
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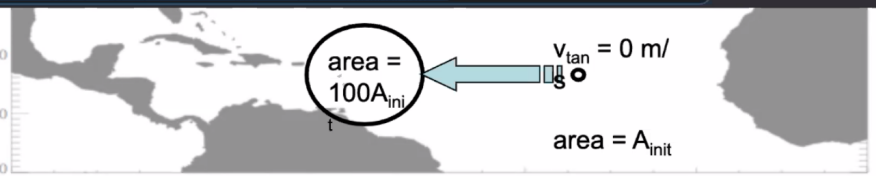
https://github.com/ATMOcanes/ATM651_2020/blob/master/Exam_and_problems/TakeHomeFinalHW.pdf



3. Circulation and vorticity (30 points)

a. (5 points) Suppose an *initially motionless* upper level loop of air at 20N (you may take $f = 5 \times 10^{-5}\ s^{-1}$ to be a constant) expands in divergent flow, (like the outflow layer of a hurricane), conserving its absolute circulation. If its enclosed area increases by a factor of 100, **what is the final absolute vorticity** within the expanded loop?

absolute $(\zeta + f)$

$\zeta_a(t_0) = 5 \times 10^{-5}\ s^{-1}$

$\zeta_a(t_1) = 5 \times 10^{-7}\ s^{-1} = (\zeta + f)_{t_1}$ relative

so $\zeta(t_1) \approx -f$ ±1%

b. (5 points) **What is the final relative circulation** around the loop?

Stokes theorem: $C = \oint V_{tan}\, dl = V_{tan} \cdot 2\pi r = \iint \zeta\, dA$

solve for V_{tan}

* anticyclonic
* can never get larger than $-f$

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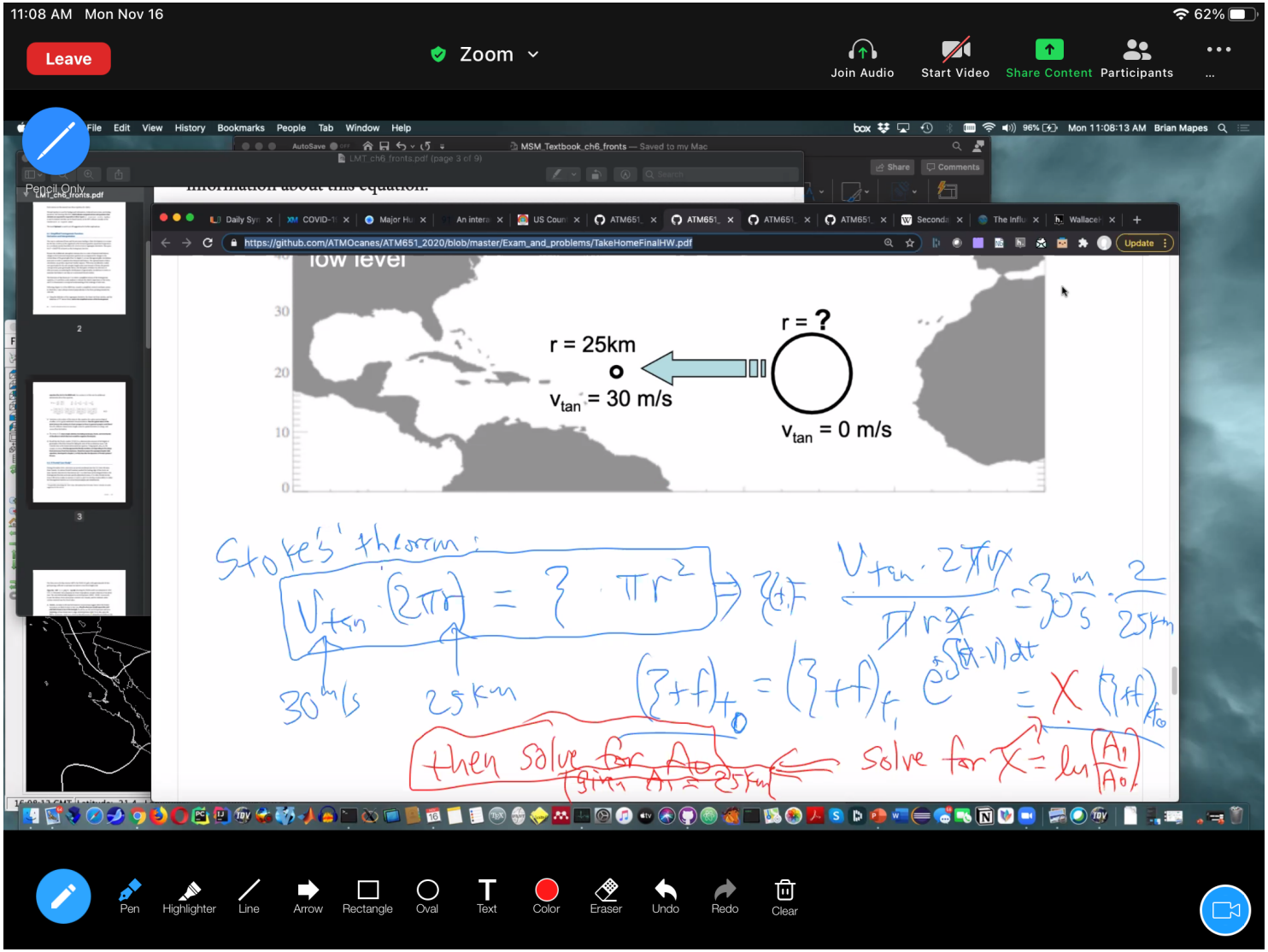
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https://github.com/ATMOcanes/ATM651_2020/blob/master/Exam_and_problems/TakeHomeFinalHW.pdf
r = 25km
r = ?
v_{tan} = 30 m/s
v_{tan} = 0 m/s
Stoke's theorem:
then solve for
solve for
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Warm core circulation: cyclone weakens with height