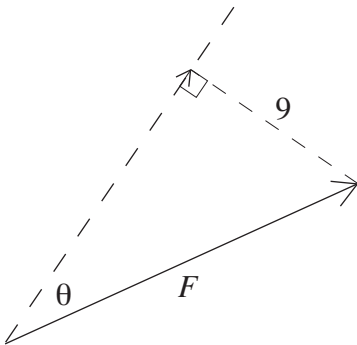


Mid-Term Exam MATH 10-270. March 2, 09. Name

Please Note: For full credit your explanations need to be complete and precise. They also need to be presented in a well organized and lucid way.

1. (15 pts) Explain what a pendentive, a pilaster, and a pier is, and draw diagrams that illustrate these architectural elements.

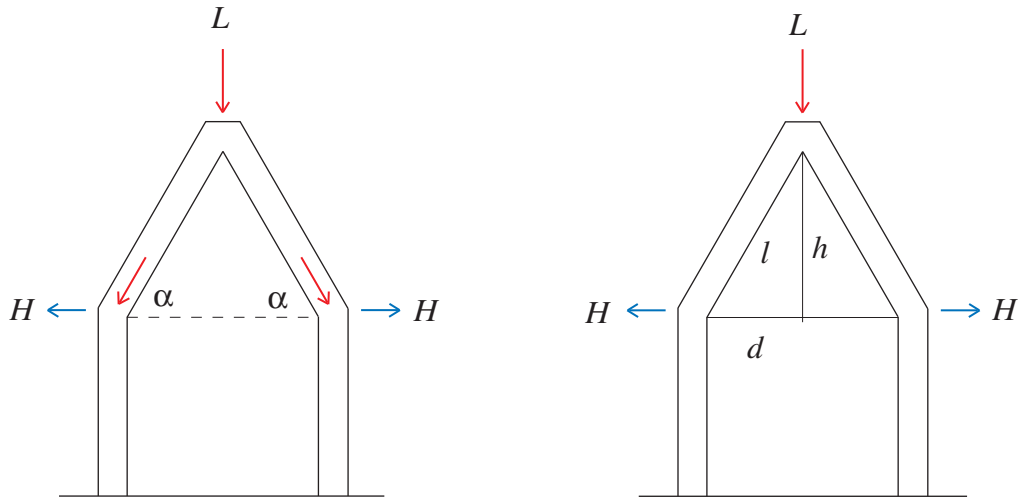
2. (10 pts) A force of magnitude 20 units is represented by the vector F in the diagram below. Use



the information given in the diagram to compute the magnitude of the component of F in the direction θ .

3. (15 pts) Which three architectural features of the Parthenon demonstrate the remarkable attention to detail as well as the precision with which the Greek architects constructed it.

4. The figures below are models of a Gothic arch. In either case, the arch is under a total load of L that is assumed to act at the top of the arch.

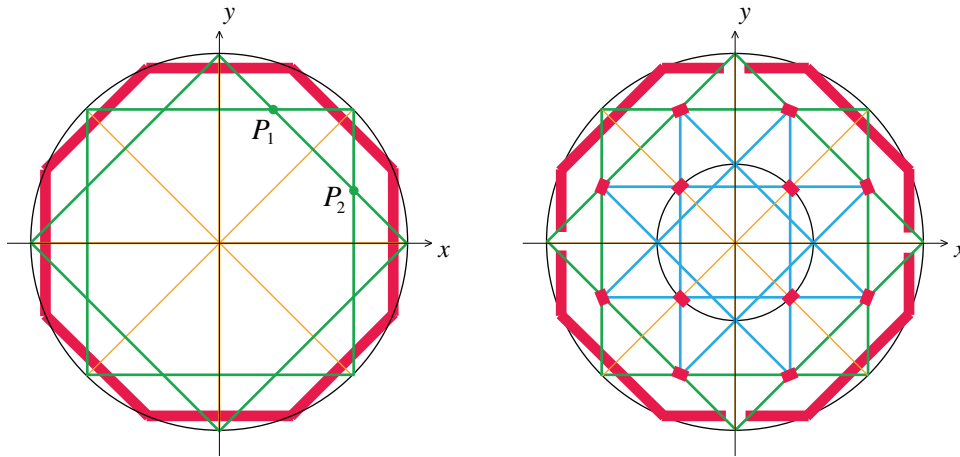


i). (15 pts) Refer to the diagram on the left and derive the formula $H = \frac{L}{2 \tan \alpha}$ for the horizontal component of the thrust down along one of the slanting elements.

In the figure on the right, d is half the span of the arch, h is the height, and l is the length of the slanting element. Suppose that the load L consists only of the combined weights of the two slanting elements in the figure. Let w be the weight per unit length of these elements.

ii). (15 pts) Show that the horizontal thrust H is given by $H = wd\sqrt{1 + \frac{d^2}{h^2}}$. Discuss how H varies relative to h with w and d held fixed.

5. Consider the plan of the Dome of the Rock shown below. An x - y coordinate system is placed into each figure in such a way that the horizontal and vertical segments lie on the x - and y -axes respectively and their point of intersection is the origin. Suppose that the surrounding circle has



radius R .

i). (10 pts) Find the equation of the line through the points P_1 and P_2 . (Your answer should involve the variables x and y and the constant R .)

ii). (10 pts) Find the equations of the horizontal line through P_1 and the vertical line through P_2 . (Your answers should involve the variables x and y and the constant R .)

iii). (10 pts) Use the information of (i) and (ii) to determine the radius of the smaller circle in the figure on the right in terms of R .