

## Math 124 Fall 2020 Final Exam

### Answers

- (a)  $f'(x) = \lim_{h \rightarrow 0} \frac{\sqrt{(x+h)^2 - 2} - \sqrt{x^2 - 2}}{h} = \frac{x}{\sqrt{x^2 - 2}}$

(b)  $\frac{\pi}{4}$ .

(c)  $\frac{1}{2}$ .

(d) 1
- (a)  $\frac{dy}{dx} = \frac{2y}{\sqrt{1 - 4x^2y^2} - 2x}$ .

(b) There would have been a horizontal tangent when  $y = 0$ , but that gives  $0 - 1 = \arcsin(2 \cdot x \cdot 0)$  which is not possible.

(c) Tangent line is  $y = 2x + 1$  so  $y \approx 2(-0.1) + 1 = 0.8$ .
- (a) Horizontal tangents at:  $\left(\frac{\sqrt{2}}{2}, 1\right)$ ,  $\left(\frac{\sqrt{2}}{2}, -1\right)$ ,  $\left(-\frac{\sqrt{2}}{2}, 1\right)$ , and  $\left(-\frac{\sqrt{2}}{2}, -1\right)$ .  
Vertical tangents at  $(1, 0)$  and  $(-1, 0)$ .

(b) At  $t = 0, \pi, \pi/2, 3\pi/2, 2\pi$  the points are  $(0, 0)$ ,  $(1, 0)$  and  $(-1, 0)$ .
- Side of the cube is  $\frac{2\sqrt{6}}{(\sqrt{3} + 1)^{1/3}}$  and the side of the tetraheadron is  $2\left(\frac{1}{1 + \sqrt{3}}\right)^{1/3}$ .
- $\frac{19}{27}$  meters per hour.
- (a)  $(-5, 2)$  and  $(8, 15)$ .

(b)  $(6, 8)$  and  $(8, 12)$ .

(c)  $x = 2$  (max),  $x = 8$  (min),  $x = 15$  (max).

(d)  $f''(6) = 0$ .

(e) 5

(f)  $f'(14) = -\frac{10}{3}$ .