1. (2 points) Evaluate and simplify the following quantity.

\[
4 \cos^2(\pi/5) + 4 \sin^2(\pi/5) - 3 \sec^2(\pi/5) - 6 \csc^2(\pi/5) + 3 \tan^2(\pi/5) + 6 \cot^2(\pi/5)
\]

\[
= 4 \left( \cos^2(\frac{\pi}{5}) + \sin^2(\frac{\pi}{5}) \right)
- 3 \left( \sec^2(\frac{\pi}{5}) - \tan^2(\frac{\pi}{5}) \right)
- 6 \left( \csc^2(\frac{\pi}{5}) - \cot^2(\frac{\pi}{5}) \right)
= 4 \cdot 1 - 3 \cdot 1 - 6 \cdot 1
= -5
\]

identities.
\[
\cos^2\theta + \sin^2\theta = 1
\]
\[
\tan^2\theta + 1 = \sec^2\theta \Rightarrow \\
\sec^2\theta - \tan^2\theta = 1
\]
\[
\cot^2\theta + 1 = \csc^2\theta \Rightarrow \\
csc^2\theta - \cot^2\theta = 1
\]

2. (2 points) Given an acute angle \(\theta\) for which \(\sin(\theta) = 2/5\), evaluate \(\sin\left(\frac{3\pi}{2} - \theta\right)\).

From the unit circle, \(\sin\left(\frac{3\pi}{2} - \theta\right) = -\cos \theta\).

\[
\theta \ \text{acute and} \ \sin \theta = \frac{2}{5} \ \text{(hyp)}
\]

By the Pythagorean Theorem,
\[
A^2 + 1^2 = 5^2
\]
\[
A = \sqrt{24}
\]

\[
\sin\left(\frac{3\pi}{2} - \theta\right) = -\cos \theta
\]

\[
= -\frac{\sqrt{24}}{5}
\]
3. (3 points) State the domain of the function using interval notation.

\[ f(x) = \frac{8 \sin(x^2 - 25)}{4 - \sqrt{2x - 6}} \]

1. \(8 \sin(x^2 - 25)\) has no restriction on the domain.
2. From \(\sqrt{2x - 6}, \ 2x - 6 \geq 0 \Rightarrow x \geq 3\)
3. Denominator = 0 when \(4 - \sqrt{2x - 6} = 0\)
   \[
   \begin{align*}
   4 &= \sqrt{2x - 6} \\
   16 &= 2x - 6 \\
   22 &= 2x \\
   x &= 11
   \end{align*}
   
   Thus, \(x \neq 11\)

Domain of \(f(x)\): \([3, 11) \cup (11, \infty)\)

4. (3 points) Use the definitions of even and odd functions to prove whether the following function is even, odd or neither.

\[ f(x) = \frac{x^4 \sin(x^3)}{x^5 - x^9} \]

\[
\begin{align*}
f(-x) &= \frac{(-x)^4 \sin((-x)^3)}{(-x)^5 - (-x)^9} \\
&= \frac{x^4 \sin(-x^3)}{-x^5 + x^9} \\
&= \frac{x^4 \cdot (-\sin(x^3))}{- (x^5 - x^9)} \\
&= \frac{x^4 \sin(x^3)}{x^5 - x^9} \\
&= f(x)
\end{align*}
\]

Since \(f(-x) = f(x)\), \(f\) is an even function.

\[
\text{since } \sin(x) \text{ is odd}
\]