1. **True/False:** The following problem

\[-u_{xx} = f, \quad x \in I = (0, 1),
\]

\[u(0) = u(1) = 0,
\]

is well-posed.

2. **True/False:** The orthogonal projection \( P_h \) onto the space \( V_h \), is the minimizer \( f^* \) of \( \| f - f^* \|_{L^2} \).

3. **True/False:** For an orthogonal basis, the mass-matrix is tri-diagonal.

4. **True/False:** Let \( f(x) = (1 - x)(1 + x) \). Then according to the trapezoidal rule,

\[
\int_{-1}^{1} f(x) \, dx \approx 0.
\]

5. **True/False:** Let \( f(x) = (x-1)(x+1) \). Then according to the midpoint rule,

\[
\int_{-1}^{1} f(x) \, dx \approx -1.
\]

6. **True/False:** Simpson’s rule is exact for cubic polynomials.
7. **True/False:** For an orthonormal basis, the mass-matrix is the identity.

8. **True/False:** Let $I = (0, 1)$. Then
\[
\int_I uv + u_x v_x \, dx \leq \left( \|u\|_{L^2(I)}^2 + \|u_x\|_{L^2(I)}^2 \right)^{1/2} \left( \|v\|_{L^2(I)}^2 + \|v_x\|_{L^2(I)}^2 \right)^{1/2}.
\]

9. **True/False:** For the orthogonal projection $P_h$ onto the space $V_h$, $P_h^2 f = P_h f$.

10. **True/False:** The following problem
\[
-u_{xx} = f, \quad x \in I = (0, 1),
\]
\[
u_x(0) = u_x(1) = 0,
\]
is well-posed.

11. **True/False:** The orthogonal projection $P_h$ onto the space $V_h$ can be shown to minimize the absolute error $\max_x |f(x) - P_h f(x)|$.

12. **True/False:** Let $u, u_x \in L^2(I), I = (0, 1)$. Suppose that $u(0) = 0$. Then
\[
\|u\|_{L^2(I)} \leq \|u_x\|_{L^2(I)}.
\]