# Residuals Quiz

**5/5 points (100%)**

Quiz, 5 questions

✔ ## Congratulations! You passed!

<div style="border:1px solid #4a90e2;">Next Item</div>

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✔ **1 / 1 points**

### 1.

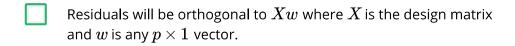Check all that are true in a general least squares setting.

☐ Residuals must always sum to 0.

**Un-selected is correct**

☐ Residuals are orthogonal to every column of the design matrix.

**Correct**

$e'Xw = y'(I - X(X'X)^{-1}X')Xw = 0$ . Choose $w$ to pick off any column of $X$.

☐ Residuals will be orthogonal to $Xw$ where $X$ is the design matrix and $w$ is any $p \times 1$ vector.

**Correct**

$e'Xw = y'(I - X(X'X)^{-1}X')Xw = 0$ .

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✔ **1 / 1 points**

### 2.

Let $X_1$ and $X_2$ be orthogonal design matrices ($X_1'X_2 = 0$). Is $H_{X_1} + H_{X_2}$ (the sum of the hat matrices) idempotent?

$\bigcirc$    Yes it is.

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$(H_{X_1} + H_{X_2})^2 = H_{X_1}^2 + H_{X_2}^2 + H_{X_1} H_{X_2} + H_{X_2} H_{X_1}$ . But
$H_{X_1} H_{X_2} = X_1 (X_1' X_1)^{-1} X_1' X_2 (X_2' X_2)^{-1} X_2' = 0$ and similarly
for $H_{X_2} H_{X_1}$.

$\bigcirc$    No it isn't

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✔    1 / 1
points

### 3.

The sum of the squared residuals are? (Check all that apply)

☐    $y'(I - H_x)y$

**Correct**
Remember this definition of residuals. It will come up a lot.

☐    $ee'$

**Un-selected is correct**

☐    $e'e$

**Correct**

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✔    1 / 1
points

### 4.

Let $H_1$ be the hat matrix associated with an intercept. Then
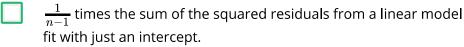$\frac{1}{n-1} y'(I - H_1)y$ is (check all that apply)?

☐    The sample variance of the $y$.

**Correct**

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☐    $\frac{1}{n-1}$ times the sum of the squared residuals from a linear model fit with just an intercept.

▲

**Correct**

☐    Always 0

▲

**Un-selected is correct**

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✔    1 / 1
points

5.

Let $X$ contain an intercept and $H_1$ and $H_X$ be the associated hat matrices for the intercept and the whole design matrix. Is the identity $H_1 = H_X H_1$ true?

◯    Yes.

▲

**Correct**
Let $J$ be a vector of ones. $(I - H_X)J = 0$ and thus $(I - H_X)H_1 = 0$

◯    No. This can't be determined without further information.

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👍    👎    🏳