Assignment 2 - Question 4

Neural Network Experiments

MLB Position Player Salary Prediction

Date: February 13, 2026

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Data Split Information:
• Training Set: 60% of data
• Validation Set: 20% of data
• Test Set: 20% of data (held out)
• Random Seed: 42 (for reproducibility)

Performance Metric: RMSE (Root Mean Squared Error)
Lower values indicate better performance.

Note: Test set is ONLY used for final evaluation
in Question 4(e) and does not participate in model selection.
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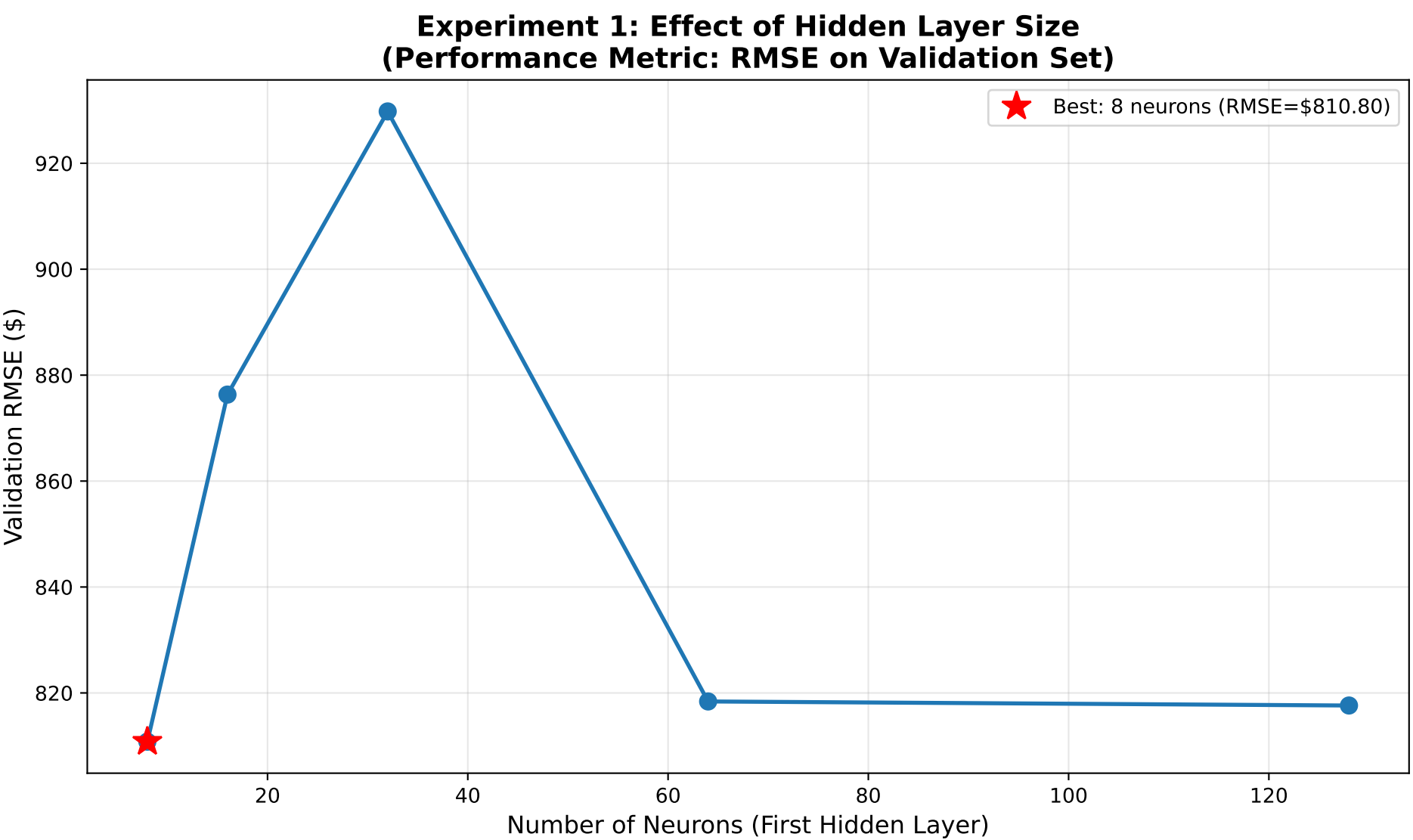
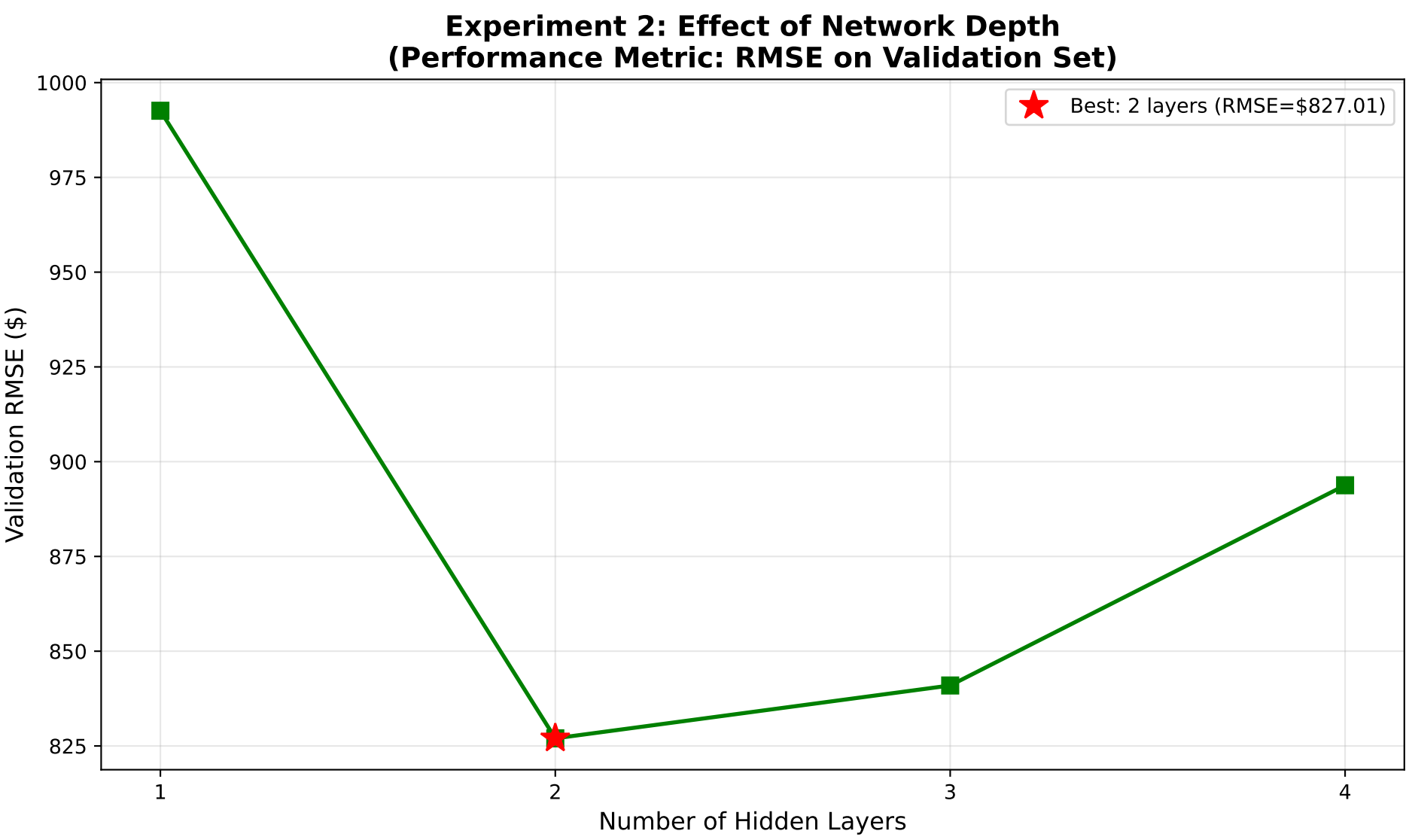
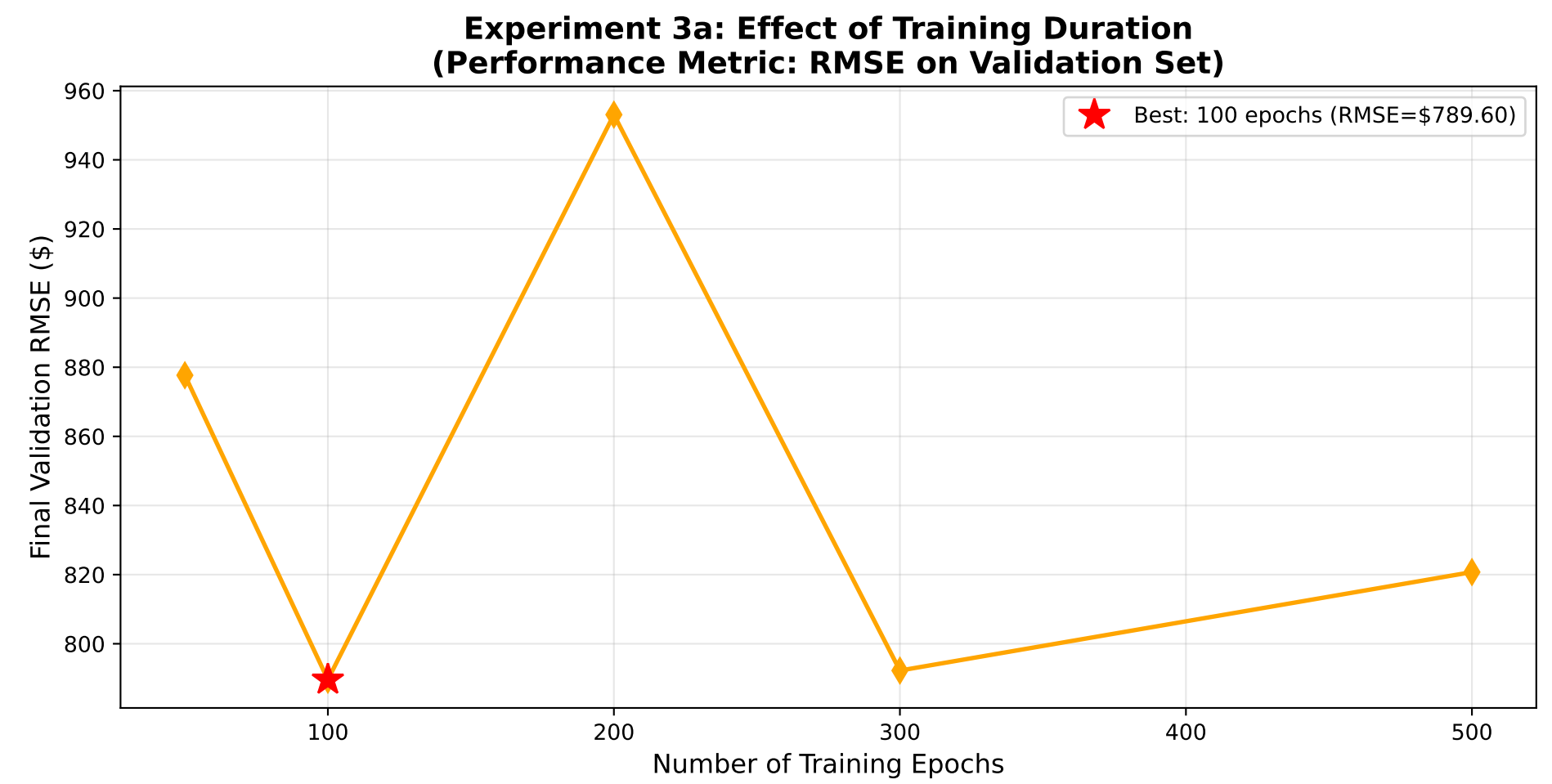
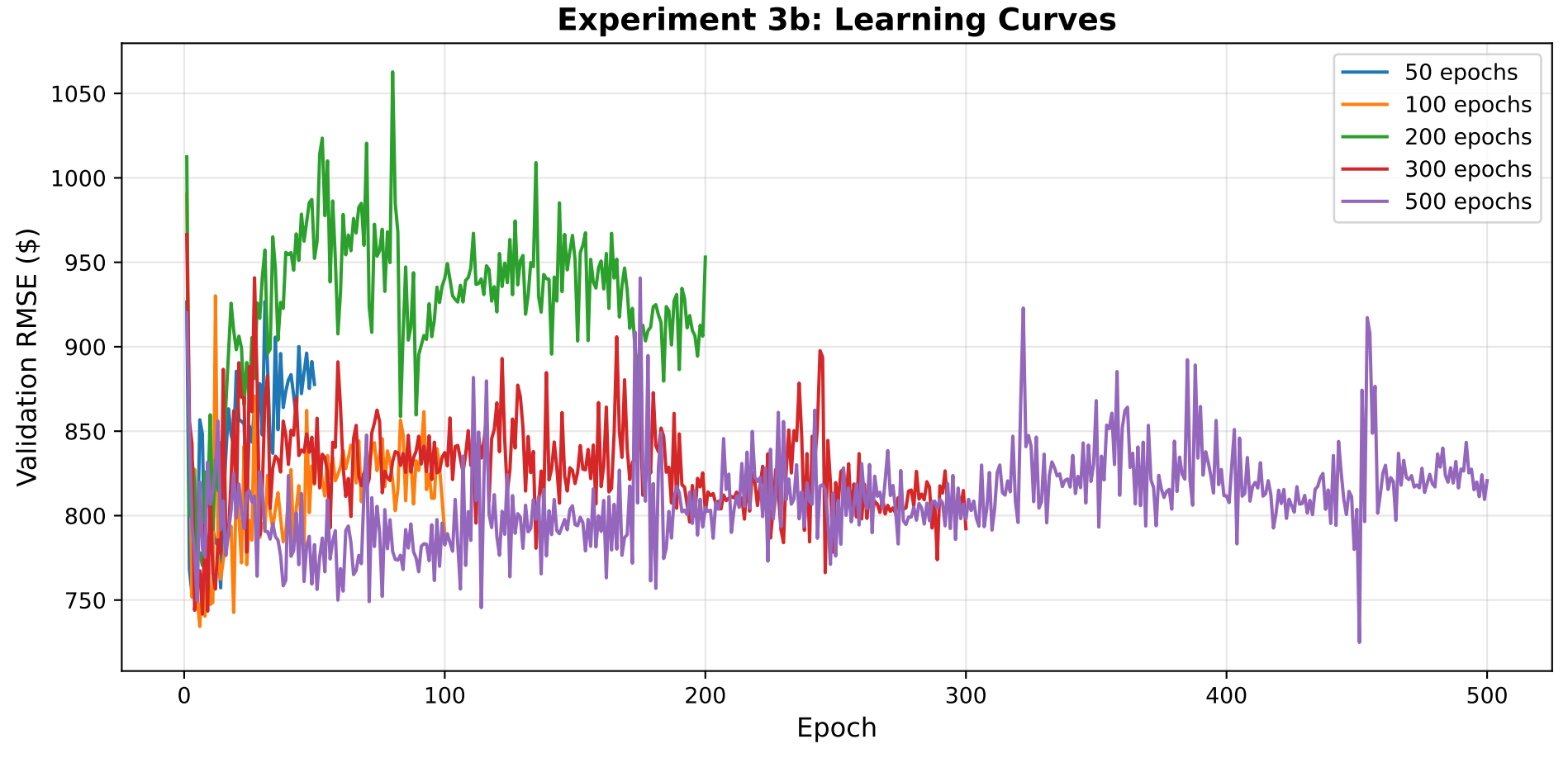
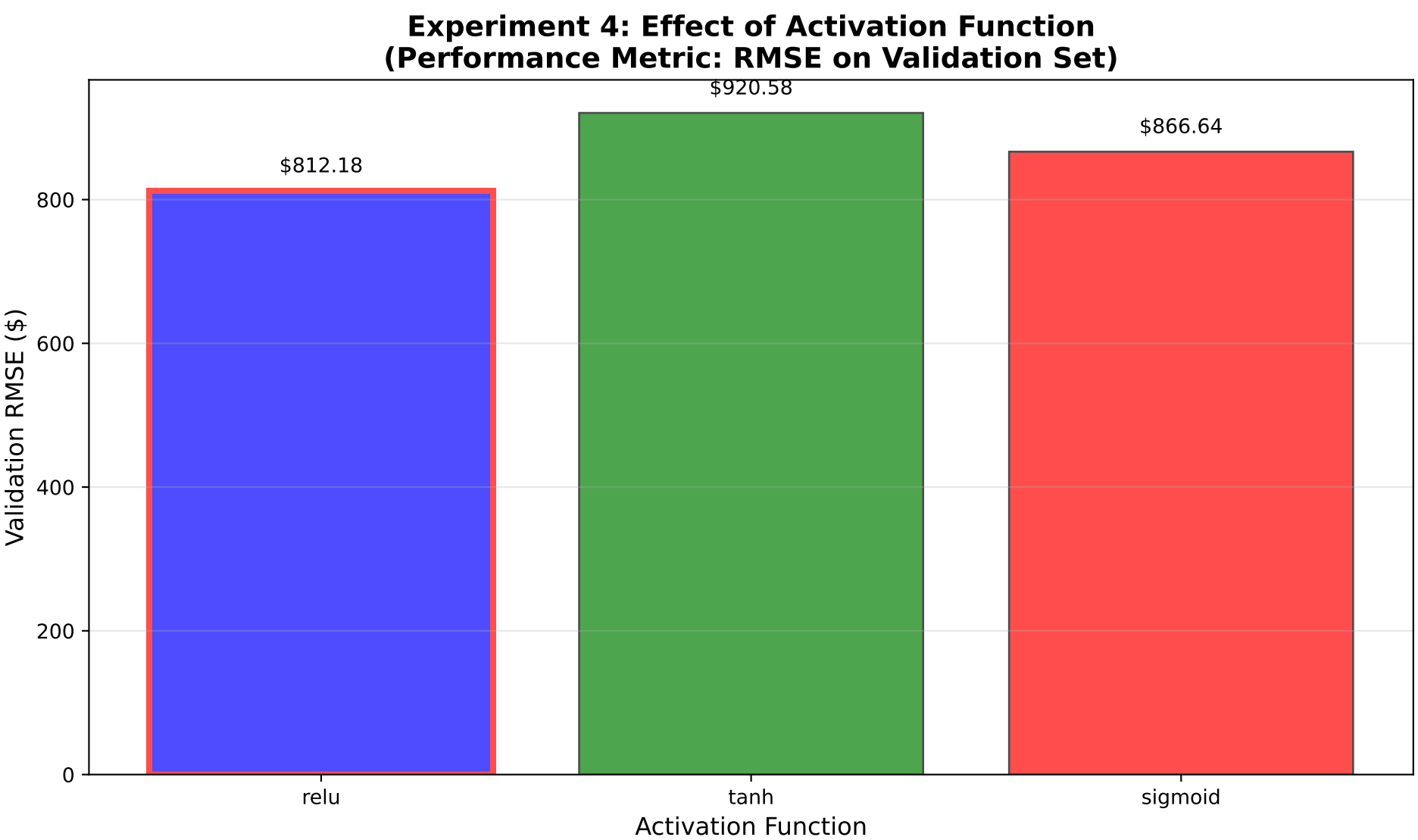

Experiment 1: Effect of Hidden Layer Size
(Performance Metric: RMSE on Validation Set)
Best: 8 neurons (RMSE=$810.80)
Validation RMSE ($)
920
900
880
860
840
820
20
40
60
80
100
120
Number of Neurons (First Hidden Layer)


Experiment 2: Effect of Network Depth
(Performance Metric: RMSE on Validation Set)
Best: 2 layers (RMSE=$827.01)
Validation RMSE ($)
1000
975
950
925
900
875
850
825
1
2
3
4
Number of Hidden Layers


Experiment 3a: Effect of Training Duration
(Performance Metric: RMSE on Validation Set)
Best: 100 epochs (RMSE=$789.60)
Final Validation RMSE ($)
960
940
920
900
880
860
840
820
800
100
200
300
400
500
Number of Training Epochs


Experiment 3b: Learning Curves
50 epochs
100 epochs
200 epochs
300 epochs
500 epochs
Validation RMSE ($)
1050
1000
950
900
850
800
750
0
100
200
300
400
500
Epoch


Experiment 4: Effect of Activation Function
(Performance Metric: RMSE on Validation Set)
$812.18
$920.58
$866.64
Validation RMSE ($)
0
200
400
600
800
relu
tanh
sigmoid
Activation Function

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QUESTION 4(e): BEST MODEL PERFORMANCE SUMMARY
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MODEL SELECTION CRITERION:
  Selected based on LOWEST validation set RMSE across all
  experiments (a-d). Test set was NOT used for model selection.

BEST CONFIGURATION (from experiments a-d):
----------------------------------------------------------------
  Source Experiment:   Training Duration
  Configuration:       100 epochs

  Full Architecture:
    • Hidden Layers:   [32, 16]
    • Activation:      relu
    • Training Epochs: 100
    • Optimizer:       Adam (lr=0.01)

PERFORMANCE ON ALL THREE SETS:
----------------------------------------------------------------
  Training Set RMSE:   $    151.80
  Validation Set RMSE: $    789.60
  Test Set RMSE:       $    724.52

GENERALIZATION ANALYSIS:
----------------------------------------------------------------
  Train-to-Val Ratio:  5.202
    → Some overfitting detected

  Val-to-Test Diff:    $65.08
    → Consistent performance

CONCLUSIONS:
----------------------------------------------------------------
  The neural network achieves a test set RMSE of $724.52
  for predicting MLB player salaries.

  Key Findings from Experiments:
  • Hidden Layer Size: 8 neurons optimal (Exp 1)
  • Network Depth: 2 layers optimal (Exp 2)
  • Training Duration: 100 epochs optimal (Exp 3)
  • Activation: relu optimal (Exp 4)

  The model demonstrates strong
  generalization from validation to test data.
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