1. When compared to some common machine learning techniques, such as random forests, generalized additive models have the advantage of clearly showing the contribution of each predictor to the response.

   True

   False

2. Generalized additive models can be thought of as a way to estimate nonlinear relationships between a response and several predictors simultaneously.

   True

   False

3. Generalized additive models strike a nice balance between the interpretable, yet biased, linear model, and the extremely flexible, "black box" machine learning algorithms.

   True

   False

4. Which of the following are additive models?

   $$f(x_1, x_2, x_3) = \beta_0 x_1 + \beta_1 x_1 + \cos(\pi x_2) + \beta_3 x_2^2 + x_1 x_2 + \sin^2(x_3)$$

   $$f(x_1, x_2, x_3) = \beta_0 x_1 + \beta_1 x_1 + \cos(\pi x_2) + \beta_3 x_2^2 + \sin^2(x_3)$$

   $$f(x_1, x_2, x_3) = \beta_0 + \beta_1 \log\left(x_1 x_3^{\beta_2}\right) - \beta_2 5^{x_3}$$

   $$f(x_1, x_2, x_3) = \beta_0 + \beta_1 e^{x_1/x_3} - \beta_2 5^{x_2}$$

   $$f(x_1, x_2) = \pi + \beta_1 e^{x_1} - 5^{x_2}$$

5. Additive models will work well when strong interactions between predictors exist.

   True

   False

6. Generalized additive models have trouble incorporating non-normal (e.g., binomial) responses.

   True

   False

7. Generalized additive models are typically more biased than standard linear regression models.

   True

   False

8. Suppose that a response y is related nonlinearly to a (continuous) predictor x_1, linearly to a (continuous) predictor x_2, and linearly to a three-level factor x_3. Then:

```
Family: gaussian
Link function: identity

Formula:
y ~ s(x1) + x2 + x3

Parametric coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.49974    0.36072   4.158 9.25e-05 ***
x2           2.81405    0.12020  23.412  < 2e-16 ***
x3B          1.02847    0.02579  39.875  < 2e-16 ***
x3C          1.94796    0.02498  77.973  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
       edf Ref.df     F p-value
s(x1) 8.283  8.853 600.9  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.994   Deviance explained = 99.5%
GCV = 0.0091693  Scale est. = 0.0077614  n = 80
```

   The mean change in y for one-unit increase in x_1, adjusting for other predictors, depends on the value of x_1.

   For a one-unit increase in x_1, the mean change in y is approximately 8.28, adjusting for other predictors.

   This model includes interaction terms.

   For a one-unit increase in x_2, the mean change in y is approximately 2.81, adjusting for other predictors.