Homework 7

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1.

$\beta_0 = 2.35$, $\beta_1 = 4.75$, $\beta_2 = 5.3$.

2. $f(x) = 3 + 5x + 3x^2 + 1.5x^3 + (x-1)_+^3$

a. $f_1(x) = 3 + 5x + 3x^2 + 1.5x^3$

b. $f_2(x) = 3 + 5x + 3x^2 + 1.5x^3 + [x^3 - 3x^2 + 3x - 1]$

$= 2 + 8x + 0x^2 + 2.5x^3$

c. $f_1(1) = 3+5+3+1.5 = 12.5 = 2+8+2.5 = f_2(1)$

d. $f_1'(1) = 5+6+4.5 = 15.5 = 8+7.5 = f_2'(1)$

e. $f_1''(1) = 6+9 = 15 = 15 = f_2''(1)$

3.

```
## Warning: package 'gam' was built under R version 4.0.5
```

```
## Loading required package: foreach
```

```
## Loaded gam 1.20.1
```

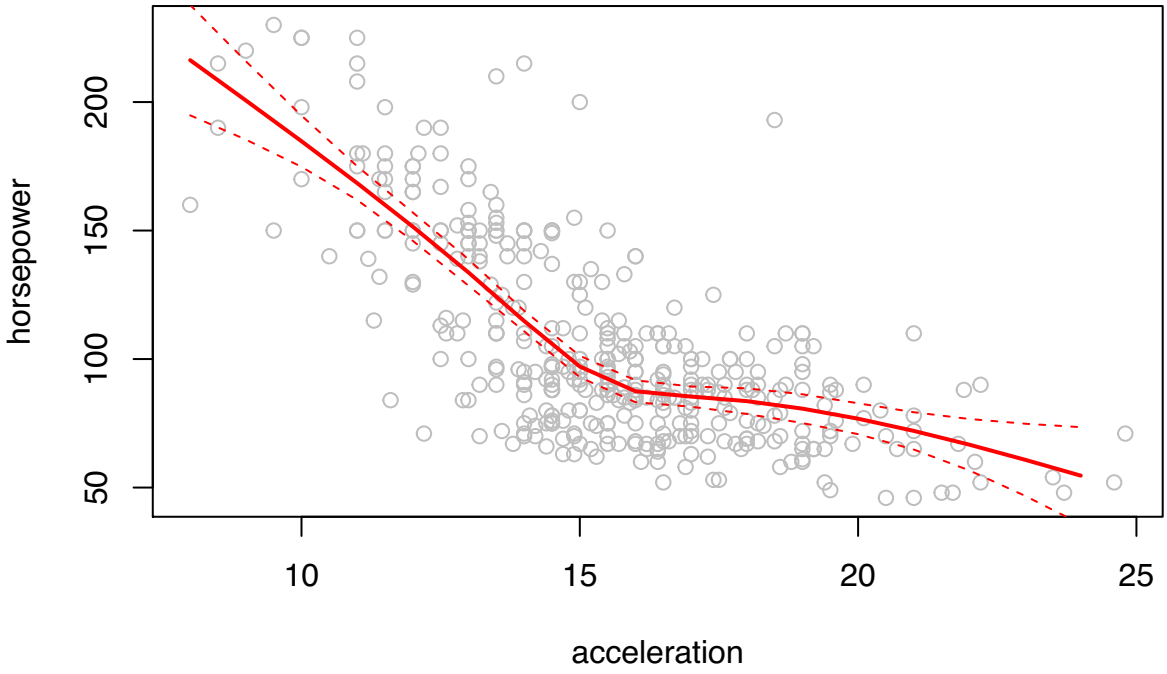
(a)

According to the ANOVA, a quadratic fit provides a reasonable fit to the data.

```
## Analysis of Variance Table
##
## Model 1: horsepower ~ acceleration
## Model 2: horsepower ~ poly(acceleration, 2)
## Model 3: horsepower ~ poly(acceleration, 3)
##   Res.Df    RSS Df Sum of Sq       F    Pr(>F)
## 1    390 304135
```

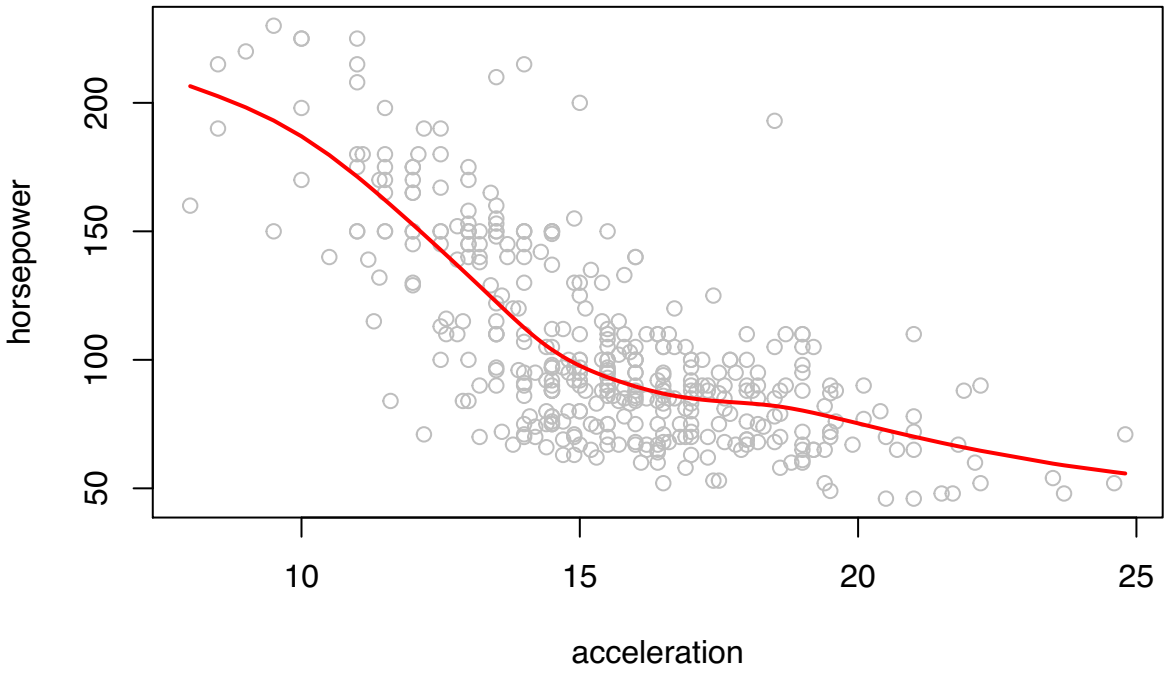
```
## 2    389 258062  1     46073 69.5644 1.306e-15 ***
## 3    388 256974  1      1087  1.6418    0.2008
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(b)



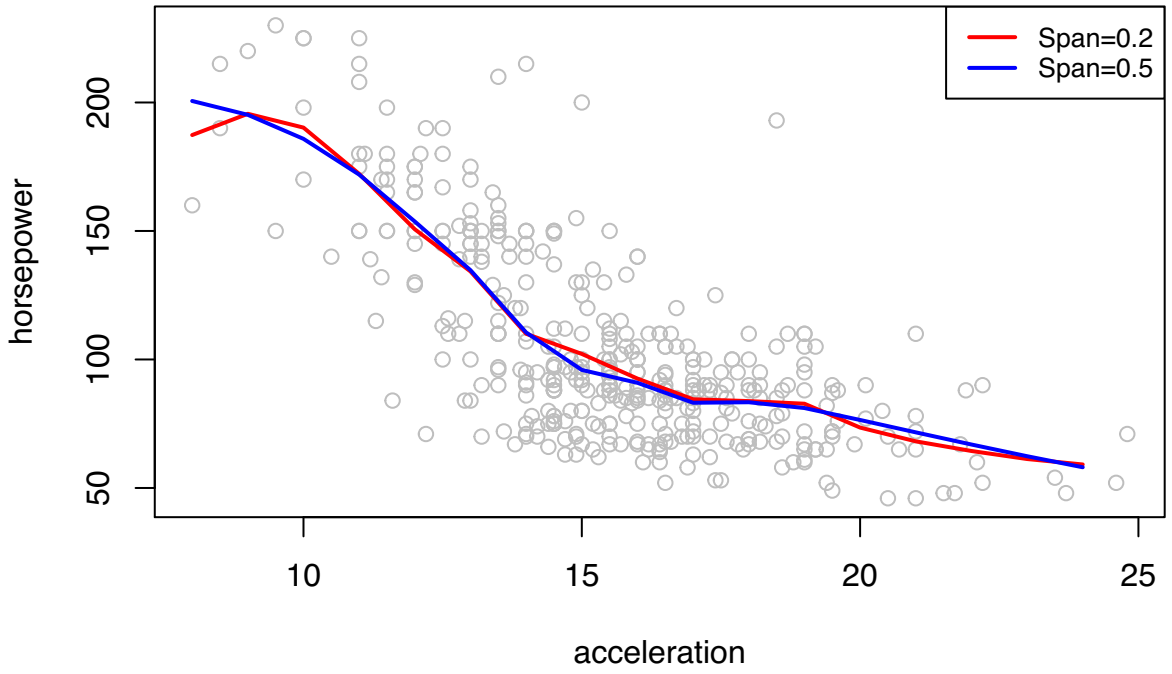
(c)

```
## [1] 7.054516
```



(d)

The model with span = 0.2 will have more bias but less variance than the model with span = 0.5 (which will have less bias but more variance).

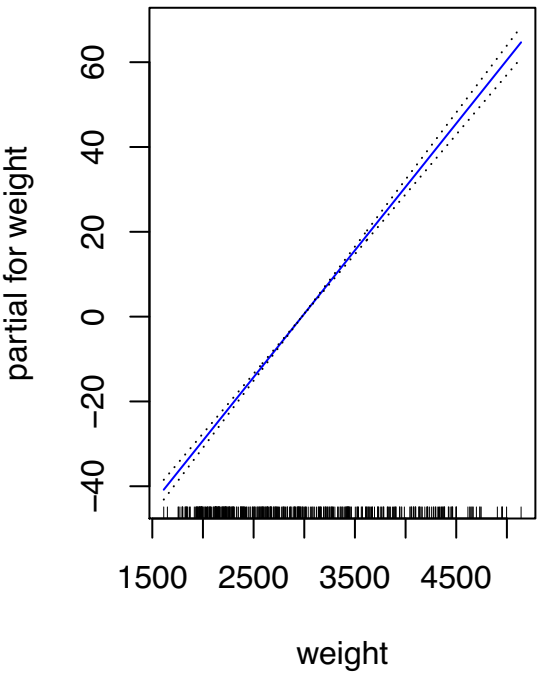


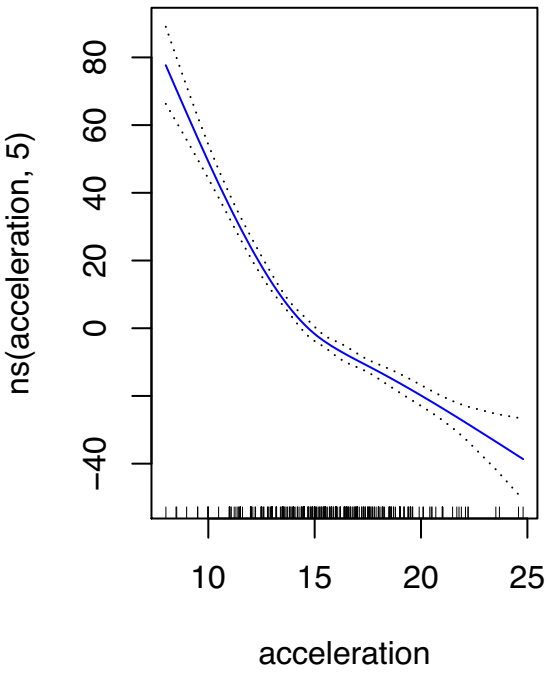
(e)

GAM #2 is the best of the fitted models for the data.

```
## Analysis of Deviance Table
##
## Model 1: horsepower ~ ns(acceleration, 5)
## Model 2: horsepower ~ weight + ns(acceleration, 5)
## Model 3: horsepower ~ ns(weight, 5) + ns(acceleration, 5)
##   Resid. Df Resid. Dev Df Deviance         F    Pr(>F)
## 1       386     243270
## 2       385      58055  1   185215 1292.4919 < 2.2e-16 ***
## 3       381      54597  4     3457    6.0318 0.0001027 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(f)


partial for weight
−40
−20
0
20
40
60
1500
2500
3500
4500
weight


ns(acceleration, 5)
−40
0
20
40
60
80
10
15
20
25
acceleration