library(MASS)  
attach(Boston)  
poly\_model\_zn <- lm(crim ~ poly(zn))  
summary(poly\_model\_zn)

##   
## Call:  
## lm(formula = crim ~ poly(zn))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.429 -4.222 -2.620 1.250 84.523   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.614 0.375 9.636 < 2e-16 \*\*\*  
## poly(zn) -38.750 8.435 -4.594 5.51e-06 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 8.435 on 504 degrees of freedom  
## Multiple R-squared: 0.04019, Adjusted R-squared: 0.03828   
## F-statistic: 21.1 on 1 and 504 DF, p-value: 5.506e-06

poly\_model\_indus <- lm(crim ~ poly( indus))  
summary(poly\_model\_indus)

##   
## Call:  
## lm(formula = crim ~ poly(indus))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -11.972 -2.698 -0.736 0.712 81.813   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3497 10.333 <2e-16 \*\*\*  
## poly(indus) 78.5908 7.8663 9.991 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.866 on 504 degrees of freedom  
## Multiple R-squared: 0.1653, Adjusted R-squared: 0.1637   
## F-statistic: 99.82 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_nox <- lm(crim ~ poly( nox))  
summary(poly\_model\_nox)

##   
## Call:  
## lm(formula = crim ~ poly(nox))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.371 -2.738 -0.974 0.559 81.728   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3472 10.41 <2e-16 \*\*\*  
## poly(nox) 81.3720 7.8100 10.42 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.81 on 504 degrees of freedom  
## Multiple R-squared: 0.1772, Adjusted R-squared: 0.1756   
## F-statistic: 108.6 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_rm <- lm(crim ~ poly( rm))  
summary(poly\_model\_rm)

##   
## Call:  
## lm(formula = crim ~ poly(rm))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.604 -3.952 -2.654 0.989 87.197   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3735 9.676 < 2e-16 \*\*\*  
## poly(rm) -42.3794 8.4006 -5.045 6.35e-07 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 8.401 on 504 degrees of freedom  
## Multiple R-squared: 0.04807, Adjusted R-squared: 0.04618   
## F-statistic: 25.45 on 1 and 504 DF, p-value: 6.347e-07

poly\_model\_age <- lm(crim ~ poly( age))  
summary(poly\_model\_age)

##   
## Call:  
## lm(formula = crim ~ poly(age))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.789 -4.257 -1.230 1.527 82.849   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3582 10.089 < 2e-16 \*\*\*  
## poly(age) 68.1820 8.0566 8.463 2.85e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 8.057 on 504 degrees of freedom  
## Multiple R-squared: 0.1244, Adjusted R-squared: 0.1227   
## F-statistic: 71.62 on 1 and 504 DF, p-value: 2.855e-16

poly\_model\_dis <- lm(crim ~ poly( dis))  
summary(poly\_model\_dis)

##   
## Call:  
## lm(formula = crim ~ poly(dis))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -6.708 -4.134 -1.527 1.516 81.674   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3541 10.205 <2e-16 \*\*\*  
## poly(dis) -73.3886 7.9654 -9.213 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.965 on 504 degrees of freedom  
## Multiple R-squared: 0.1441, Adjusted R-squared: 0.1425   
## F-statistic: 84.89 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_rad <- lm(crim ~ poly( rad))  
summary(poly\_model\_rad)

##   
## Call:  
## lm(formula = crim ~ poly(rad))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -10.164 -1.381 -0.141 0.660 76.433   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.2986 12.1 <2e-16 \*\*\*  
## poly(rad) 120.9074 6.7178 18.0 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.718 on 504 degrees of freedom  
## Multiple R-squared: 0.3913, Adjusted R-squared: 0.39   
## F-statistic: 323.9 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_tax <- lm(crim ~ poly( tax))  
summary(poly\_model\_tax)

##   
## Call:  
## lm(formula = crim ~ poly(tax))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -12.513 -2.738 -0.194 1.065 77.696   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3111 11.62 <2e-16 \*\*\*  
## poly(tax) 112.6458 6.9969 16.10 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 6.997 on 504 degrees of freedom  
## Multiple R-squared: 0.3396, Adjusted R-squared: 0.3383   
## F-statistic: 259.2 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_ptratio <- lm(crim ~ poly( ptratio))  
summary(poly\_model\_ptratio)

##   
## Call:  
## lm(formula = crim ~ poly(ptratio))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -7.654 -3.985 -1.912 1.825 83.353   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3663 9.864 < 2e-16 \*\*\*  
## poly(ptratio) 56.0452 8.2402 6.801 2.94e-11 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 8.24 on 504 degrees of freedom  
## Multiple R-squared: 0.08407, Adjusted R-squared: 0.08225   
## F-statistic: 46.26 on 1 and 504 DF, p-value: 2.943e-11

poly\_model\_black <- lm(crim ~ poly( black))  
summary(poly\_model\_black)

##   
## Call:  
## lm(formula = crim ~ poly(black))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.756 -2.299 -2.095 -1.296 86.822   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3532 10.229 <2e-16 \*\*\*  
## poly(black) -74.4312 7.9462 -9.367 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.946 on 504 degrees of freedom  
## Multiple R-squared: 0.1483, Adjusted R-squared: 0.1466   
## F-statistic: 87.74 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_lstat <- lm(crim ~ poly( lstat))  
summary(poly\_model\_lstat)

##   
## Call:  
## lm(formula = crim ~ poly(lstat))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -13.925 -2.822 -0.664 1.079 82.862   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3407 10.61 <2e-16 \*\*\*  
## poly(lstat) 88.0697 7.6645 11.49 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.664 on 504 degrees of freedom  
## Multiple R-squared: 0.2076, Adjusted R-squared: 0.206   
## F-statistic: 132 on 1 and 504 DF, p-value: < 2.2e-16

poly\_model\_medv <- lm(crim ~ poly( medv))  
summary(poly\_model\_medv)

##   
## Call:  
## lm(formula = crim ~ poly(medv))  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -9.071 -4.022 -2.343 1.298 80.957   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.6135 0.3527 10.24 <2e-16 \*\*\*  
## poly(medv) -75.0576 7.9345 -9.46 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 7.934 on 504 degrees of freedom  
## Multiple R-squared: 0.1508, Adjusted R-squared: 0.1491   
## F-statistic: 89.49 on 1 and 504 DF, p-value: < 2.2e-16