

Exercise #6

Data Points:

i	1	2	3	4	5	6	7	8	9	10
Paid (in thousand)	20	20	25	27	30	30	33	35	35	40
ROI (in ten thousand)	8.75	9.43	12.87	14.24	16.89	18.94	25.48	30.11	36.07	51.27

Independent: amount paid over a period of time

amount_paid = c(20, 20, 25, 27, 30, 30, 33, 35, 35, 40) * 10³

```
> amount_paid
[1] 20000 20000 25000 27000 30000 30000 33000 35000 35000 40000
```

Dependent: amount of return of investment

amount_roi = c(8.75, 9.43, 12.87, 14.24, 16.89, 18.94, 25.48, 30.11, 36.07, 51.27) * 10⁴

```
> amount_roi
[1] 87500 94300 128700 142400 168900 189400 254800 301100 360700 512700
```

→ Polynomial Regression for Degree 1

```
> insurancePR_deg1
$augcoefficientmatrix
      [,1]      [,2]      [,3]
[1,]    10 2.950e+05  2240500
[2,] 295000 9.093e+09 73526700000

$coefficients
[1] -337390.52497      19.03188

$polynomial_string
[1] "function(x) -337390.524967989 + 19.0318822023047 * x ^ 1"

$polynomial_function
function(x) -337390.524967989 + 19.0318822023047 * x ^ 1
<environment: 0x000001f06354ece0>
```

**For checking (using R's built-in function)

```
> linearModel$coefficients
(Intercept)  amount_paid
-337390.52497      19.03188
```

→ Polynomial Regression for Degree 2

```
> insurancePR_deg2
$augcoefficientmatrix
      [,1]      [,2]      [,3]      [,4]
[1,] 1.000e+01 2.95000e+05 9.093000e+09 2.240500e+06
[2,] 2.950e+05 9.09300e+09 2.909950e+14 7.352670e+10
[3,] 9.093e+09 2.90995e+14 9.609237e+18 2.487939e+15

$coefficients
[1] 5.894574e+05 -4.768121e+01 1.145044e-03

$polynomial_string
[1] "function(x) 589457.390099361 + -47.6812072692684 * x ^ 1 + 0.00114504368673052 * x ^ 2"

$polynomial_function
function(x) 589457.390099361 + -47.6812072692684 * x ^ 1 + 0.00114504368673052 * x ^ 2
<environment: 0x000001f062270e78>
```

**For checking (using R's built-in function)

```
> quadraticModel$coefficients
      (Intercept) poly(amount_paid, 2, raw = TRUE)1 poly(amount_paid, 2, raw = TRUE)2
      5.894574e+05                -4.768121e+01                1.145044e-03
```

→ Polynomial Regression for Degree 3

```
> insurancePR_deg3
$augcoefficientmatrix
      [,1]      [,2]      [,3]      [,4]      [,5]
[1,] 1.00000e+01 2.95000e+05 9.093000e+09 2.909950e+14 2.240500e+06
[2,] 2.95000e+05 9.093000e+09 2.909950e+14 9.609237e+18 7.352670e+10
[3,] 9.09300e+09 2.909950e+14 9.609237e+18 3.256937e+23 2.487939e+15
[4,] 2.90995e+14 9.609237e+18 3.256937e+23 1.128156e+28 8.628652e+19

$coefficients
[1] 3.604610e+05 -2.309493e+01 2.955009e-04 9.491247e-09

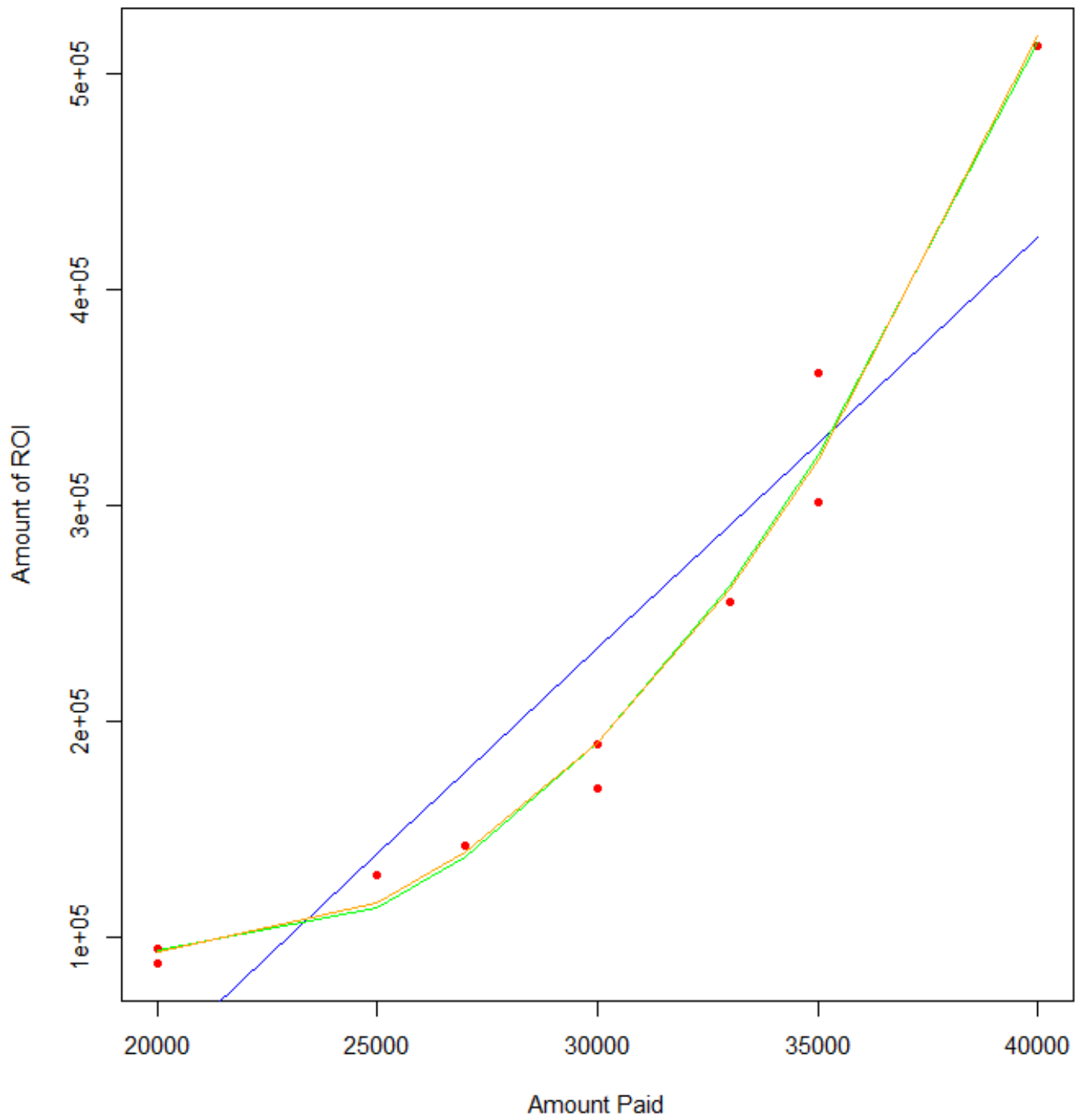
$polynomial_string
[1] "function(x) 360460.961895687 + -23.0949316501825 * x ^ 1 + 0.000295500927200264 * x ^ 2 + 9.4912465396827e-09 * x ^ 3"

$polynomial_function
function(x) 360460.961895687 + -23.0949316501825 * x ^ 1 + 0.000295500927200264 * x ^ 2 + 9.4912465396827e-09 * x ^ 3
<environment: 0x000001f062577fd0>
```

**For checking (using R's built-in function)

```
> cubicModel$coefficients
      (Intercept) poly(amount_paid, 3, raw = TRUE)1 poly(amount_paid, 3, raw = TRUE)2 poly(amount_paid, 3, raw = TRUE)3
      3.604610e+05                -2.309493e+01                2.955009e-04                9.491247e-09
```

Amount of ROI vs. Amount Paid



BLUE : degree 1 polynomial

GREEN : degree 2 polynomial

ORANGE : degree 3 polynomial