|  |  |
| --- | --- |
| **Student Name** | Imaad Hajwane |
| **SRN No** | 202101132 |
| **Roll No** | 23 |
| **Program** | Computer Engineering |
| **Year** | Third Year |
| **Division** | A |
| **Subject** | DMPM |
| **Assignment No** | Three |

**DMPM Lab Assignment -3 Linear Regression Model**

1. Read the dataset that is provided to you.
2. Build a suitable linear regression model using R.
3. Analyze the predicted values of the response variable.
4. Compute the residuals and plot the residual values.
5. Develop some metrics to determine the accuracy of your regression model
6. Save your R command file.
7. Save your code and results in a Word file and submit it on the VOLP.

The R function **lm** is used to fit linear (regression) models. The syntax for this command is given below:

**lm(formula, data, subset, weights, na.action, method = "qr", model = TRUE, x = FALSE, y = FALSE, qr =**

**TRUE, singular.ok = TRUE, contrasts = NULL, offset, …)**

Type >help(lm) in Rstudio to get detailed help on **lm** command.

In help also check for *“An object of class "lm" is a list containing at least the following components”* how to retrieve various components of object of class lm.

**Code:**

**rm(list = ls())**

**DF <- read\_excel("P:/College/SEM - 6/LAB/DMPM\_Lab/Titanic\_DFset.xlsx") View(DF)**

**DF$age[is.na(DF$age)] <- mean(DF$age, na.rm = TRUE) DF$fare[is.na(DF$fare)] <- mean(DF$fare, na.rm = TRUE)**

**plot(DF$age, DF$fare, xlab = "Age",**

**ylab = "Fare",**

**main = "Scatter Plot of Age vs Fare")**

**install.packages('caTools') library(caTools)**

**split = sample.split(DF$fare, SplitRatio = 0.7) trainingset = subset(DF, split == TRUE) testset = subset(DF, split == FALSE)**

**lm.r = lm(fare ~ age, DF) lm.r**

**summary(lm.r)**

**Pre = predict(lm.r, DF)**

**Pre library(ggplot2)**

**ggplot() + geom\_point(aes(x = trainingset$age, y = trainingset$fare), colour = 'red') + geom\_line(aes(x = trainingset$age, y = predict(lm.r, newdata = trainingset)), colour = 'blue') + ggtitle('Fare vs Age (Training set)') +**

**xlab('Age') +**

**ylab('Fare')**

**ggplot() + geom\_point(aes(x = testset$age, y = testset$fare), colour = 'red') + geom\_line(aes(x = testset$age, y = predict(lm.r, newdata = testset)), colour = 'blue') + ggtitle('Fare vs Age (Test set)') +**

**xlab('Age') +**

**ylab('Fare')**

**DIFF = (DF$fare) - (Pre) DIFF**

**#parameter's to evaluate linear model MSE = mean((DIFF)^2) #mean square error**

**MSE**

**MAE = mean(abs(DIFF)) #mean absolute error MAE**

**RMSE = sqrt(MSE) #root mean square error RMSE**

**R\_2 = 1 - (sum((DIFF)^2) / sum((DF$fare - mean(DF$fare))^2))**

**R\_2**

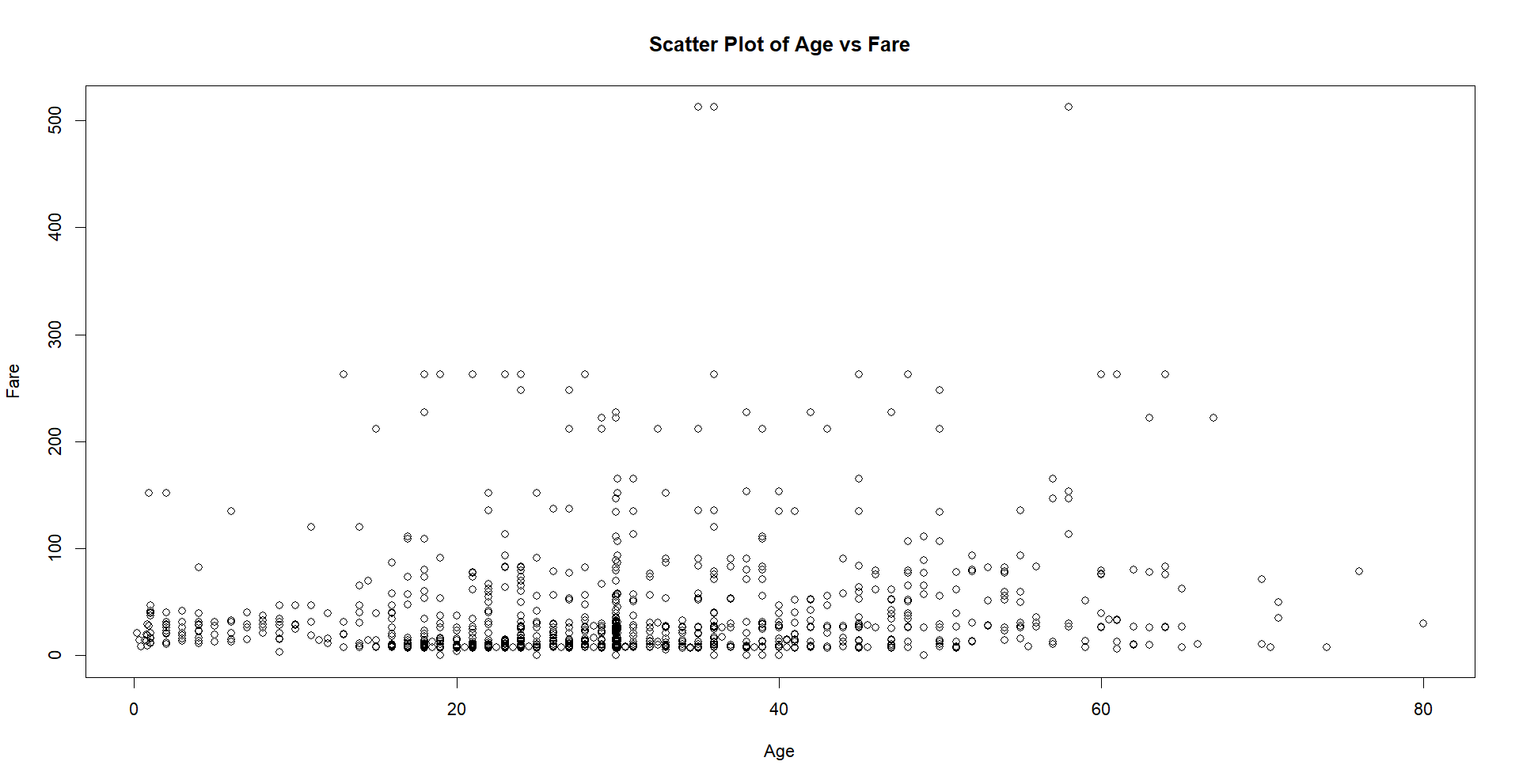
**cat("MAE: ", MAE, "\n", "MSE: ", MSE, "\n", "RMSE: ", RMSE, "\n", "R-squared: ", R\_2)**

**Output:**



*Figure 1 - View(DF)*

* DF$age[is.na(DF$age)] <- mean(DF$age, na.rm = TRUE)



* DF$fare[is.na(DF$fare)] <- mean(DF$fare, na.rm = TRUE)
* plot(DF$age, DF$fare,

+ xlab = "Age",

+ ylab = "Fare",

+ main = "Scatter Plot of Age vs Fare")

* install.packages('caTools')

Error in install.packages : Updating loaded packages

* install.packages("caTools") Warning in install.packages :

package ‘caTools’ is in use and will not be installed

* library(caTools)
* split = sample.split(DF$fare, SplitRatio = 0.7)
* trainingset = subset(DF, split == TRUE)
* testset = subset(DF, split == FALSE)
* lm.r = lm(fare ~ age, DF)
* lm.r Call:

lm(formula = fare ~ age, data = DF)

Coefficients:

(Intercept) age

12.7126 0.6888

* summary(lm.r) Call:

lm(formula = fare ~ age, data = DF)

Residuals:

Min 1Q Median 3Q Max

-55.91 -24.75 -17.19 3.10 475.51

Coefficients:

Estimate Std. Error t value Pr(>|t|) (Intercept) 12.7126 3.5609 3.570 0.00037 \*\*\*

age 0.6888 0.1094 6.294 4.21e-10 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1 Residual standard error: 50.99 on 1307 degrees of freedom Multiple R-squared: 0.02942, Adjusted R-squared: 0.02868

F-statistic: 39.62 on 1 and 1307 DF, p-value: 4.21e-10

* Pre = predict(lm.r, DF)
* Pre

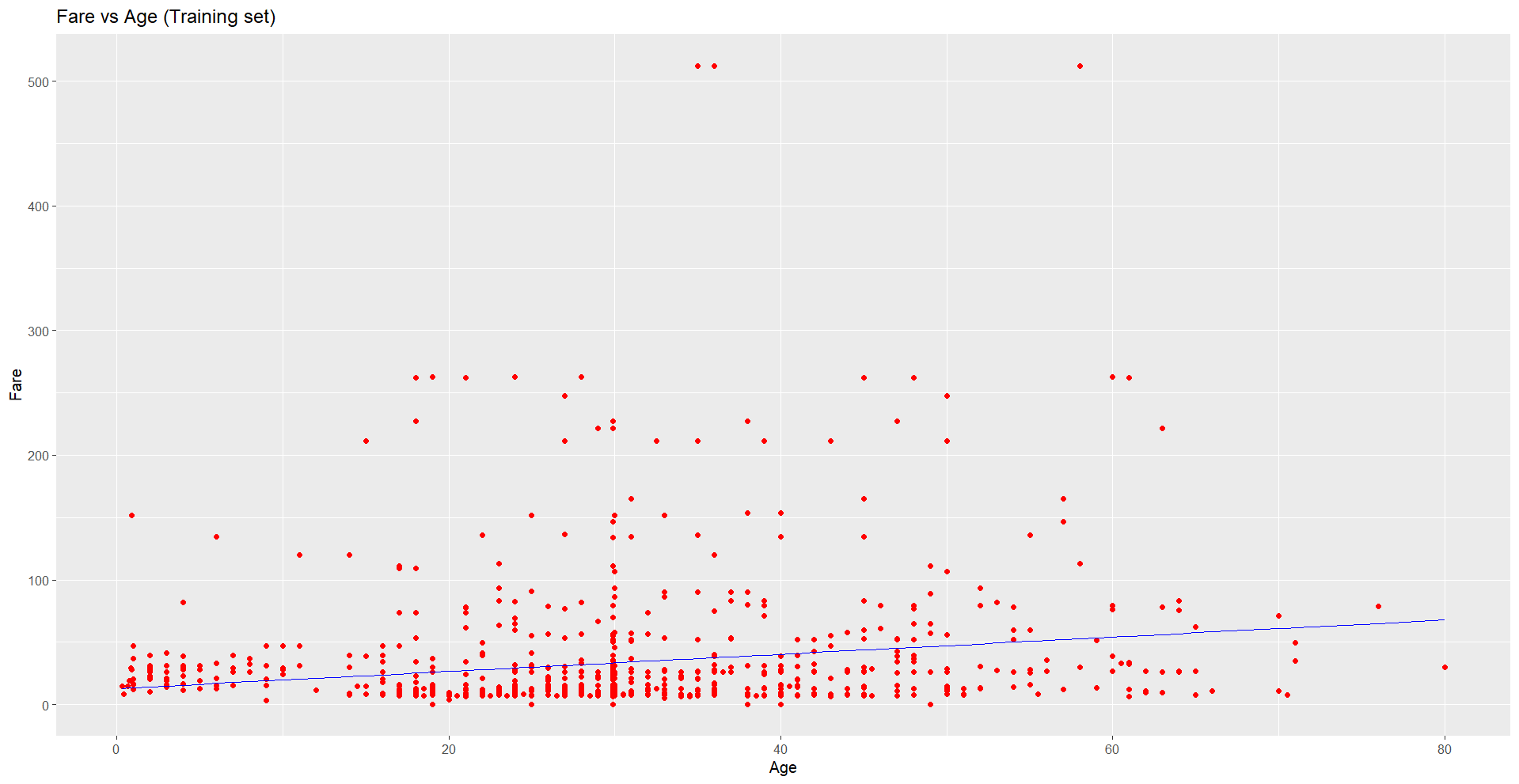
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 32.68853 | 13.34403 | 14.09023 | 33.37736 | 29.93323 | 45.77622 | 56.10861 | 39.57679 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 49.22035 | 61.61922 | 45.08740 | 25.11145 | 29.24440 | 30.62205 | 67.81865 | 33.29548 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 29.24440 | 47.15388 | 34.75501 | 37.51031 | 38.19914 | 45.08740 | 30.62205 | 41.64327 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 32.68853 | 29.93323 | 29.93323 | 25.80027 | 36.82149 | 31.99971 | 43.70975 | 40.26562 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 33.37736 | 52.66448 | 41.64327 | 43.70975 | 27.86675 | 33.29548 | 40.95444 | 45.77622 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 33.29548 | 43.02092 | 53.35331 | 54.04214 | 40.95444 | 43.70975 | 33.29548 | 41.64327 |
| 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 |
| 49.22035 | 37.51031 | 52.66448 | 35.44383 | 31.99971 | 24.42262 | 20.28966 | 22.35614 |
| 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 |
| 37.51031 | 37.51031 | 46.46505 | 33.29548 | 37.51031 | 65.06335 | 44.39857 | 45.08740 |
| 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| 31.31088 | 35.44383 | 37.51031 | 33.37736 | 43.70975 | 33.29548 | 33.29548 | 31.31088 |
| 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 30.62205 | 27.86675 | 33.29548 | 45.08740 | 39.57679 | 38.19914 | 56.79744 | 50.59801 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 |
| 33.29548 | 60.93039 | 37.51031 | 56.79744 | 39.57679 | 38.88796 | 47.84270 | 31.31088 |
| 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 |
| 35.44383 | 34.06618 | 31.31088 | 34.06618 | 24.42262 | 49.22035 | 15.46788 | 49.90918 |
| 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 |
| 47.15388 | 31.31088 | 45.77622 | 45.77622 | 46.46505 | 39.57679 | 28.55558 | 38.88796 |
| 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 |
| 49.90918 | 37.51031 | 33.29548 | 33.29548 | 33.29548 | 37.51031 | 33.37736 | 29.24440 |
| 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 31.99971 | 28.55558 | 25.80027 | 56.79744 | 54.04214 | 33.37736 | 33.29548 | 47.15388 |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 |
| 42.33209 | 33.29548 | 27.86675 | 54.04214 | 45.77622 | 33.29548 | 38.19914 | 36.82149 |
| 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 |
| 45.08740 | 36.82149 | 27.86675 | 43.70975 | 29.24440 | 46.46505 | 33.29548 | 61.61922 |
| 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 |
| 49.22035 | 25.80027 | 38.88796 | 52.66448 | 28.55558 | 43.70975 | 44.39857 | 29.93323 |
| 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 |
| 29.93323 | 45.77622 | 46.46505 | 33.29548 | 43.70975 | 36.82149 | 40.26562 | 31.31088 |
| 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 |
| 33.29548 | 29.24440 | 50.59801 | 48.53153 | 41.64327 | 33.29548 | 50.59801 | 23.73379 |
| 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 |
| 43.02092 | 47.84270 | 41.64327 | 36.82149 | 36.82149 | 38.88796 | 33.29548 | 36.82149 |
| 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 |
| 38.88796 | 47.15388 | 46.46505 | 44.39857 | 47.15388 | 35.09942 | 52.66448 | 40.95444 |
| 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 |
| 33.29548 | 41.64327 | 43.70975 | 33.29548 | 39.57679 | 46.46505 | 33.37736 | 36.82149 |
| 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 |
| 33.29548 | 41.64327 | 50.59801 | 23.73379 | 47.84270 | 32.68853 | 27.17792 | 33.37736 |
| 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |
| 52.66448 | 23.04497 | 33.37736 | 23.73379 | 33.29548 | 25.80027 | 25.11145 | 29.24440 |
| 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 |
| 44.39857 | 49.90918 | 37.51031 | 31.99971 | 33.29548 | 57.48627 | 43.02092 | 35.44383 |
| 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 |
| 38.19914 | 33.37736 | 50.59801 | 45.08740 | 38.19914 | 34.06618 | 28.55558 | 52.66448 |
| 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 |
| 25.80027 | 56.79744 | 39.57679 | 33.29548 | 27.86675 | 57.48627 | 32.34412 | 33.29548 |
| 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
| 44.05416 | 28.55558 | 32.68853 | 27.86675 | 25.11145 | 24.42262 | 33.37736 | 48.53153 |
| 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |  |
| 45.08740 | 51.28683 | 38.88796 | 33.29548 | 27.86675 | 33.29548 | 42.33209 | 34.06618 |  |
| 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 |  |
| 43.70975 | 33.29548 | 35.44383 | 44.39857 | 37.51031 | 35.44383 | 50.59801 | 49.90918 |  |
| 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 |  |
| 35.44383 | 21.66732 | 25.11145 | 27.17792 | 54.73096 | 45.77622 | 33.29548 | 29.24440 |  |
| 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 |  |
| 33.29548 | 36.82149 | 33.37736 | 36.13266 | 40.26562 | 36.82149 | 47.15388 | 39.57679 |  |
| 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 |  |
| 51.28683 | 31.99971 | 51.28683 | 51.28683 | 29.24440 | 33.29548 | 25.11145 | 29.24440 |  |
| 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 |  |
| 28.55558 | 16.84553 | 43.70975 | 40.26562 | 51.97566 | 33.29548 | 34.75501 | 55.41979 |  |
| 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 |  |
| 49.90918 | 42.33209 | 48.53153 | 33.29548 | 55.41979 | 58.86392 | 56.10861 | 54.73096 |  |
| 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 |  |
| 45.77622 | 25.11145 | 48.53153 | 39.57679 | 45.77622 | 33.29548 | 46.46505 | 24.42262 |  |
| 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 |  |
| 39.57679 | 33.29548 | 34.06618 | 40.26562 | 54.73096 | 45.08740 | 36.82149 | 56.79744 |  |
| 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 |  |
| 54.04214 | 54.04214 | 49.90918 | 27.17792 | 50.59801 | 34.06618 | 51.97566 | 43.70975 |  |
| 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 |  |
| 47.15388 | 31.31088 | 47.15388 | 27.17792 | 47.84270 | 27.17792 | 33.29548 | 34.06618 |  |
| 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 |  |
| 33.29548 | 55.41979 | 37.51031 | 33.37736 | 31.99971 | 33.37736 | 25.11145 | 29.93323 |  |
| 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 |  |
| 36.13266 | 37.51031 | 51.97566 | 25.11145 | 28.55558 | 37.51031 | 31.99971 | 47.84270 |  |
| 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 |  |
| 34.75501 | 25.80027 | 31.99971 | 13.40140 | 15.46788 | 20.97849 | 37.51031 | 36.13266 |  |
| 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 |  |
| 25.80027 | 28.55558 | 30.62205 | 41.64327 | 31.31088 | 29.24440 | 23.04497 | 54.04214 |  |
| 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 |  |
| 40.26562 | 26.48910 | 29.93323 | 37.51031 | 29.93323 | 41.64327 | 41.64327 | 13.28658 |  |
| 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 |  |
| 30.62205 | 27.86675 | 36.82149 | 33.29548 | 25.80027 | 43.02092 | 49.90918 | 48.53153 |  |
| 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 |  |
| 38.19914 | 32.68853 | 29.93323 | 43.70975 | 32.68853 | 31.99971 | 32.68853 | 31.99971 |  |
| 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 |  |
| 29.24440 | 18.22319 | 34.06618 | 34.06618 | 27.86675 | 33.37736 | 33.29548 | 27.17792 |  |
| 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 |  |
| 33.29548 | 18.22319 | 25.11145 | 45.77622 | 31.99971 | 34.75501 | 24.42262 | 32.68853 |  |
| 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 |  |
| 29.24440 | 29.93323 | 25.11145 | 25.11145 | 36.13266 | 49.90918 | 18.22319 | 41.64327 |  |
| 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 |  |
| 36.13266 | 31.31088 | 33.37736 | 28.55558 | 27.17792 | 25.11145 | 40.26562 | 32.68853 |  |
| 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 |  |
| 25.11145 | 37.51031 | 33.29548 | 38.88796 | 36.82149 | 38.88796 | 36.13266 | 36.13266 |  |
| 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |  |
| 23.73379 | 30.62205 | 45.08740 | 27.17792 | 27.17792 | 29.24440 | 29.24440 | 36.13266 |  |
| 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 |  |
| 33.37736 | 48.53153 | 33.37736 | 13.17182 | 29.24440 | 43.02092 | 16.84553 | 31.99971 |  |
| 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 |  |
| 55.41979 | 33.37736 | 17.53436 | 42.33209 | 43.70975 | 29.24440 | 29.24440 | 46.46505 |  |
| 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 |  |
| 45.77622 | 50.59801 | 29.24440 | 34.75501 | 27.17792 | 25.11145 | 26.48910 | 28.55558 |  |
| 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 |  |
| 37.51031 | 49.90918 | 47.15388 | 43.02092 | 32.68853 | 27.17792 | 41.64327 | 56.10861 |  |
| 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 |  |
| 54.04214 | 35.44383 | 24.42262 | 41.64327 | 29.24440 | 45.08740 | 29.24440 | 27.86675 |  |
| 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 |  |
| 34.75501 | 28.55558 | 36.13266 | 29.24440 | 27.86675 | 33.29548 | 36.82149 | 43.70975 |  |
| 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 |  |
| 51.97566 | 33.29548 | 34.06618 | 30.62205 | 33.37736 | 33.29548 | 13.40140 | 14.77906 |  |
| 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
| 29.93323 | 27.86675 | 24.42262 | 33.29548 | 36.13266 | 37.51031 | 29.24440 | 54.73096 |  |
| 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 |  |
| 47.15388 | 41.64327 | 51.97566 | 33.29548 | 13.40140 | 34.06618 | 29.24440 | 33.29548 |  |
| 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 |  |
| 33.37736 | 40.26562 | 34.75501 | 33.37736 | 44.39857 | 21.66732 | 40.95444 | 25.80027 |  |
| 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 |  |
| 39.57679 | 45.77622 | 60.93039 | 31.31088 | 49.90918 | 39.57679 | 23.73379 | 55.41979 |  |
| 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 |  |
| 35.09942 | 22.35614 | 14.09023 | 14.77906 | 37.85473 | 30.62205 | 25.80027 | 31.99971 |  |
| 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 |  |
| 26.48910 | 32.68853 | 39.57679 | 27.86675 | 33.29548 | 28.55558 | 32.68853 | 31.99971 |  |
| 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 |  |
| 33.29548 | 47.15388 | 25.80027 | 33.29548 | 40.95444 | 27.17792 | 25.80027 | 42.33209 |  |
| 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 |  |
| 34.75501 | 36.13266 | 33.37736 | 31.31088 | 14.09023 | 18.22319 | 35.44383 | 37.51031 |  |
| 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 |  |
| 36.13266 | 33.37736 | 31.99971 | 28.55558 | 13.28658 | 14.77906 | 29.24440 | 47.15388 |  |
| 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 |  |
| 25.80027 | 27.17792 | 30.62205 | 29.93323 | 31.31088 | 29.93323 | 25.11145 | 26.48910 |  |
| 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 |  |
| 33.37736 | 53.35331 | 33.37736 | 36.82149 | 40.26562 | 29.93323 | 40.95444 | 29.93323 |  |
| 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 |  |
| 25.45586 | 22.35614 | 47.15388 | 28.55558 | 31.99971 | 31.31088 | 32.68853 | 31.31088 |  |
| 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 |  |
| 40.26562 | 34.06618 | 33.37736 | 28.55558 | 34.06618 | 33.29548 | 20.97849 | 40.26562 |  |
| 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 |  |
| 35.09942 | 31.31088 | 32.68853 | 14.09023 | 15.46788 | 32.68853 | 13.34403 | 16.15671 |  |
| 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 |  |
| 37.51031 | 35.44383 | 58.17509 | 33.29548 | 34.06618 | 33.29548 | 30.62205 | 29.24440 |  |
| 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 |  |
| 41.64327 | 21.66732 | 23.73379 | 36.82149 | 23.73379 | 29.93323 | 26.48910 | 25.11145 |  |
| 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 |  |
| 33.37736 | 30.62205 | 40.26562 | 13.28658 | 25.11145 | 30.62205 | 30.62205 | 26.48910 |  |
| 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 |  |
| 29.24440 | 29.93323 | 36.82149 | 25.11145 | 34.75501 | 25.80027 | 15.46788 | 16.84553 |  |
| 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 |  |
| 14.09023 | 24.42262 | 38.88796 | 18.91201 | 20.28966 | 39.57679 | 31.31088 | 30.62205 |  |
| 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 |  |
| 39.57679 | 26.48910 | 30.62205 | 29.93323 | 25.11145 | 29.24440 | 36.82149 | 16.15671 |  |
| 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 |  |
| 18.91201 | 14.77906 | 21.66732 | 16.15671 | 40.26562 | 28.55558 | 38.88796 | 43.70975 |  |
| 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 |  |
| 27.17792 | 28.55558 | 24.42262 | 33.37736 | 28.55558 | 21.66732 | 26.48910 | 34.75501 |  |
| 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 |  |
| 35.44383 | 13.22920 | 13.22920 | 16.15671 | 29.24440 | 25.11145 | 40.26562 | 30.62205 |  |
| 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 |  |
| 26.48910 | 25.11145 | 43.70975 | 31.31088 | 27.86675 | 25.80027 | 30.62205 | 27.86675 |  |
| 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 |  |
| 33.29548 | 26.48910 | 34.75501 | 27.17792 | 25.11145 | 30.62205 | 16.84553 | 18.91201 |  |
| 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 |  |
| 33.29548 | 33.29548 | 33.29548 | 40.26562 | 34.75501 | 27.17792 | 27.86675 | 26.48910 |  |
| 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 |  |
| 32.68853 | 27.86675 | 27.86675 | 36.82149 | 25.45586 | 27.17792 | 25.80027 | 25.11145 |  |
| 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 |  |
| 27.17792 | 33.37736 | 25.11145 | 38.88796 | 24.42262 | 24.42262 | 27.17792 | 27.17792 |  |
| 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 |  |
| 27.17792 | 33.29548 | 33.29548 | 31.99971 | 29.24440 | 23.73379 | 38.19914 | 31.99971 |  |
| 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 |  |
| 29.24440 | 27.17792 | 34.75501 | 32.68853 | 30.62205 | 25.11145 | 26.48910 | 25.11145 |  |
| 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 |  |
| 29.24440 | 37.51031 | 29.24440 | 34.06618 | 34.06618 | 27.86675 | 33.37736 | 61.27481 |  |
| 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 |  |
| 42.33209 | 36.82149 | 31.31088 | 25.80027 | 33.37736 | 18.91201 | 14.77906 | 37.51031 |  |
| 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
| 53.35331 | 25.80027 | 24.42262 | 43.02092 | 24.42262 | 28.21116 | 43.70975 | 27.86675 |  |
| 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 |  |
| 25.80027 | 33.37736 | 32.68853 | 12.94216 | 36.13266 | 31.99971 | 31.31088 | 29.93323 |  |
| 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 |  |
| 29.24440 | 27.86675 | 27.17792 | 24.42262 | 33.29548 | 33.29548 | 37.85473 | 37.51031 |  |
| 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 |  |
| 33.37736 | 23.73379 | 13.40140 | 12.82741 | 30.62205 | 35.44383 | 29.93323 | 33.29548 |  |
| 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 |  |
| 33.29548 | 27.86675 | 37.51031 | 25.80027 | 24.42262 | 41.64327 | 42.33209 | 33.29548 |  |
| 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 |  |
| 34.75501 | 25.80027 | 33.37736 | 29.24440 | 28.55558 | 35.44383 | 57.48627 | 29.24440 |  |
| 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 |  |
| 28.55558 | 27.86675 | 25.11145 | 23.73379 | 43.70975 | 33.29548 | 39.57679 | 24.42262 |  |
| 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 |  |
| 23.04497 | 45.08740 | 16.15671 | 33.29548 | 40.61003 | 40.61003 | 33.29548 | 25.11145 |  |
| 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 |  |
| 33.29548 | 33.29548 | 33.29548 | 30.62205 | 33.29548 | 33.29548 | 27.17792 | 18.91201 |  |
| 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 |  |
| 33.29548 | 25.11145 | 23.73379 | 45.77622 | 33.29548 | 33.29548 | 29.93323 | 33.29548 |  |
| 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 |  |
| 33.29548 | 27.86675 | 23.73379 | 33.29548 | 18.91201 | 35.44383 | 40.95444 | 34.06618 |  |
| 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 |  |
| 38.88796 | 18.91201 | 13.40140 | 20.28966 | 19.60084 | 23.73379 | 22.35614 | 40.26562 |  |
| 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 |  |
| 42.33209 | 47.84270 | 34.75501 | 33.29548 | 26.48910 | 38.19914 | 31.99971 | 25.80027 |  |
| 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 |  |
| 29.24440 | 24.42262 | 33.29548 | 33.29548 | 31.99971 | 29.24440 | 26.48910 | 28.89999 |  |
| 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 |  |
| 40.95444 | 30.62205 | 27.17792 | 43.70975 | 33.29548 | 29.93323 | 33.29548 | 20.28966 |  |
| 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 |  |
| 33.29548 | 31.31088 | 33.29548 | 25.11145 | 30.62205 | 28.55558 | 27.86675 | 31.99971 |  |
| 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 |  |
| 31.99971 | 33.29548 | 14.09023 | 27.86675 | 42.33209 | 31.99971 | 31.31088 | 33.29548 |  |
| 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 |  |
| 33.29548 | 41.64327 | 33.29548 | 33.37736 | 33.29548 | 31.31088 | 29.93323 | 33.29548 |  |
| 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 |  |
| 32.68853 | 27.17792 | 33.29548 | 26.48910 | 45.77622 | 24.42262 | 33.29548 | 33.29548 |  |
| 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 |  |
| 36.13266 | 30.62205 | 27.86675 | 35.44383 | 34.06618 | 32.68853 | 15.46788 | 13.40140 |  |
| 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 |  |
| 46.46505 | 35.44383 | 25.80027 | 31.31088 | 33.29548 | 33.29548 | 33.29548 | 33.29548 |  |
| 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 |  |
| 28.55558 | 34.75501 | 31.31088 | 26.48910 | 27.17792 | 34.75501 | 24.42262 | 27.17792 |  |
| 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 |  |
| 33.37736 | 27.17792 | 35.44383 | 27.86675 | 15.46788 | 39.57679 | 33.29548 | 25.45586 |  |
| 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 |  |
| 33.29548 | 33.29548 | 33.29548 | 33.29548 | 36.47707 | 43.02092 | 33.29548 | 33.29548 |  |
| 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 |  |
| 33.29548 | 33.29548 | 33.29548 | 33.29548 | 27.86675 | 30.62205 | 15.46788 | 32.68853 |  |
| 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 |  |
| 30.62205 | 13.40140 | 25.11145 | 37.51031 | 33.29548 | 29.93323 | 33.29548 | 38.19914 |  |
| 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 |  |
| 33.29548 | 33.29548 | 33.29548 | 27.86675 | 33.29548 | 30.62205 | 32.68853 | 32.68853 |  |
| 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 |  |
| 27.86675 | 27.86675 | 33.29548 | 33.29548 | 33.29548 | 33.29548 | 33.29548 | 34.75501 |  |
| 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 |  |
| 36.47707 | 33.29548 | 33.29548 | 37.51031 | 39.57679 | 29.24440 | 29.93323 | 43.70975 |  |
| 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 |  |
| 37.51031 | 33.37736 | 26.48910 | 33.29548 | 31.99971 | 33.29548 | 33.37736 | 30.62205 |  |
| 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 |  |
| 33.29548 | 26.83351 | 31.31088 | 47.84270 | 28.55558 | 34.75501 | 33.29548 | 33.29548 |  |
| 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 |  |
| 33.29548 | 29.24440 | 27.86675 | 33.29548 | 33.29548 | 33.29548 | 32.68853 | 33.29548 |  |
| 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 |  |

33.72177 33.29548 33.29548 36.82149 35.44383 33.29548 33.29548 33.29548



* library(ggplot2)
* ggplot() + geom\_point(aes(x = trainingset$age, y = trainingset$fare), colour

= 'red') +

+ geom\_line(aes(x = trainingset$age, y = predict(lm.r, newdata = trainingset)), colour = 'blue') +

+ ggtitle('Fare vs Age (Training set)') +

+ xlab('Age') +

+ ylab('Fare')

* ggplot() + geom\_point(aes(x = testset$age, y = testset$fare), colour = 'red')

+

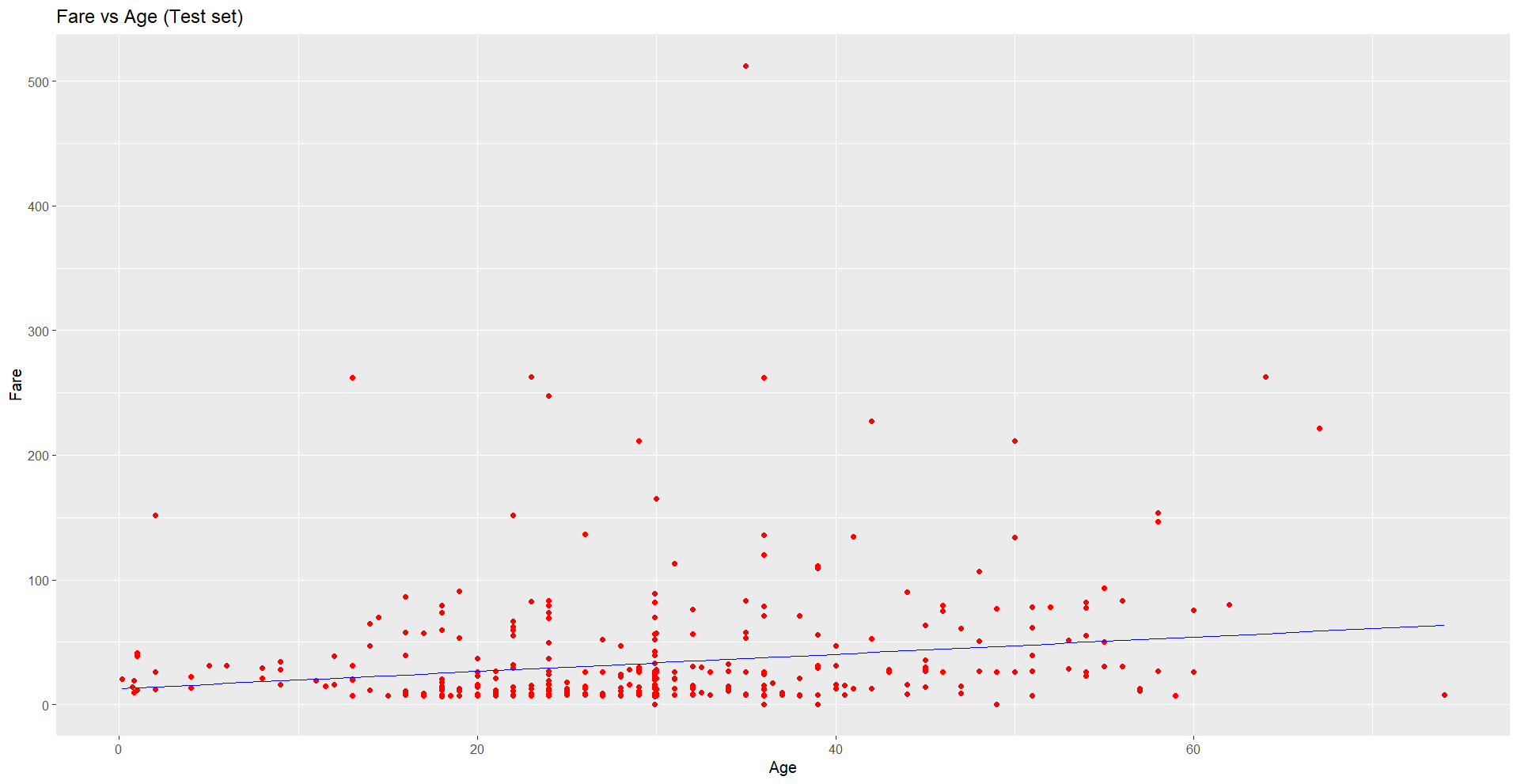
+ geom\_line(aes(x = testset$age, y = predict(lm.r, newdata = testset)), colour

= 'blue') +

+ ggtitle('Fare vs Age (Test set)') +

+ xlab('Age') +

+ ylab('Fare')



* DIFF = (DF$fare) - (Pre)
* DIFF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 |
| 178.64896903 | 138.20597476 | 137.45976961 | 118.17264309 | 121.61677282 |
| 6 | 7 | 8 | 9 | 10 |
| -19.22622396 | 21.84968683 | -39.57679044 | 2.25884630 | -12.11502075 |
| 11 | 12 | 13 | 14 | 15 |
| 182.43760198 | 202.41355445 | 40.05559877 | 48.22794688 | -37.81865428 |
| 16 | 17 | 18 | 19 | 20 |
| -7.37047928 | 218.27639877 | 200.36692414 | 41.53669119 | 37.73138740 |
| 21 | 22 | 23 | 24 | 25 |
| 14.35506146 | 7.46680198 | -0.62205312 | 185.88173172 | 189.09066903 |
| 26 | 27 | 28 | 29 | 30 |
| -3.93322718 | 61.14597282 | 65.27892851 | 98.81181335 | -5.44970502 |
| 31 | 32 | 33 | 34 | 35 |
| -8.20974612 | -9.26561639 | 131.48934309 | -26.11448344 | -15.09326828 |
| 36 | 37 | 38 | 39 | 40 |
| 218.66525388 | 27.13325066 | -6.74547928 | -10.45444233 | 4.71957604 |
| 41 | 42 | 43 | 44 | 45 |
| 6.30452072 | -15.30012018 | -1.87410938 | 22.24956467 | 93.54555767 |
| 46 | 47 | 48 | 49 | 50 |
| -17.15974612 | -2.29547928 | -15.35576828 | -21.77455370 | 474.81888740 |
| 51 | 52 | 53 | 54 | 55 |
| 459.66471656 | -30.44383476 | 15.10029498 | 22.67738040 | 99.71033608 |
| 56 | 57 | 58 | 59 | 60 |
| 97.64385824 | 82.48968740 | 82.48968740 | -20.46504991 | -5.57467928 |
| 61 | 62 | 63 | 64 | 65 |
| 41.33968740 | 13.78664951 | 16.77642793 | 16.08760198 | 21.78912093 |
| 66 | 67 | 68 | 69 | 70 |
| 17.65616524 | 224.86468740 | 53.12264309 | -14.00974612 | 21.70452072 |
| 71 | 72 | 73 | 74 | 75 |
| -33.29547928 | 105.46832093 | 106.15714688 | 123.68325066 | 18.70452072 |
| 76 | 77 | 78 | 79 | 80 |
| -19.49989802 | 43.58150956 | 44.95916146 | 26.36086088 | -24.89800559 |
| 81 | 82 | 83 | 84 | 85 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| -6.74547928 | 10.06960520 | 33.48968740 | -30.24743912 | 31.70650956 |
| 86 | 87 | 88 | 89 | 90 |  |
| 32.39533551 | -21.29270181 | -0.81087907 | 116.10616524 | 17.93381714 |  |
| 91 | 92 | 93 | 94 | 95 |  |
| 20.68912093 | 22.93381714 | 32.57738040 | 32.63794630 | 66.39041772 |  |
| 96 | 97 | 98 | 99 | 100 |  |
| 31.94912035 | 59.27112414 | 216.20992093 | 60.64877604 | -6.17622396 |  |
| 101 | 102 | 103 | 104 | 105 |  |
| 10.46415009 | -9.87679044 | 54.60272472 | 188.63703551 | 28.35752035 |  |
| 106 | 107 | 108 | 109 | 110 |  |
| -5.83111260 | 188.48372072 | -1.61217928 | 77.58782072 | -11.12281260 |  |
| 111 | 112 | 113 | 114 | 115 |  |
| -5.62735691 | 233.75559877 | 231.00029498 | 234.44442472 | 237.19972851 |  |
| 116 | 117 | 118 | 119 | 120 |  |
| 206.20256088 | 208.95786467 | 23.55184309 | -6.74547928 | 86.49612414 |  |
| 121 | 122 | 123 | 124 | 125 |  |
| -14.61129423 | 100.35452072 | 21.63325066 | 25.15786467 | 33.42377604 |  |
| 126 | 127 | 128 | 129 | 130 |  |
| -33.29547928 | 14.90086146 | 16.27851335 | -6.58739802 | 174.67851335 |  |
| 131 | 132 | 133 | 134 | 135 |  |
| 31.53325066 | 15.69025388 | 49.95559877 | 42.63915009 | 55.80872072 |  |
| 136 | 137 | 138 | 139 | 140 |  |
| -26.96502075 | -20.72035370 | 4.19972851 | 114.57453551 | 100.79801656 |  |
| 141 | 142 | 143 | 144 | 145 |  |
| 34.80272472 | 19.64855388 | 34.80142793 | 25.50847282 | 25.50847282 |  |
| 146 | 147 | 148 | 149 | 150 |  |
| 30.95297604 | 30.26415009 | 9.10452072 | 39.76525388 | 46.65351335 |  |
| 151 | 152 | 153 | 154 | 155 |  |
| -40.26561639 | 45.41832093 | -3.29547928 | 53.91389877 | 42.90199441 |  |
| 156 | 157 | 158 | 159 | 160 |  |
| 44.96847225 | 0.85673172 | 18.56702072 | -0.59800559 | 34.24540635 |  |
| 161 | 162 | 163 | 164 | 165 |  |
| 14.95827982 | 30.11559819 | 10.35673172 | 15.17851335 | -10.27148665 |  |
| 166 | 167 | 168 | 169 | 170 |  |
| 51.11203551 | -2.59967928 | 53.17851335 | 41.11203551 | -18.44137586 |  |
| 171 | 172 | 173 | 174 | 175 |  |
| -46.46504991 | -18.39857207 | -21.15387586 | 176.40057822 | -22.96448344 |  |
| 176 | 177 | 178 | 179 | 180 |  |
| 10.90805767 | 18.56702072 | 10.91093172 | 8.84445388 | -6.74547928 |  |
| 181 | 182 | 183 | 184 | 185 |  |
| 171.76070956 | -20.53584991 | 73.04764309 | 475.50771335 | -5.57467928 |  |
| 186 | 187 | 188 | 189 | 190 |  |
| -15.09326828 | -22.87720559 | 15.66620635 | -8.44270181 | -2.68853097 |  |
| 191 | 192 | 193 | 194 | 195 |  |
| 50.78037661 | 12.12264309 | 93.85631656 | 188.29253230 | -7.37735691 |  |
| 196 | 197 | 198 | 199 | 200 |  |
| 62.76620635 | -3.59547928 | 27.29972851 | 27.98855445 | 20.25979877 |  |
| 201 | 202 | 203 | 204 | 205 |  |
| 30.84312793 | 1.95332035 | -11.22281260 | 50.17109498 | 48.87532072 |  |
| 206 | 207 | 208 | 209 | 210 |  |
| -30.93626507 | 46.97907982 | 54.55616524 | 51.80086146 | 24.37264309 |  |
| 211 | 212 | 213 | 214 | 215 |  |
| -20.09800559 | -2.68739802 | -8.49913854 | 79.20881714 | 84.71942472 |  |
| 216 | 217 | 218 | 219 | 220 |  |
| 60.61051656 | 0.48302851 | -30.79743912 | 69.32320956 | -7.55377928 |  |
| 221 | 222 | 223 | 224 | 225 |  |
| 34.11245066 | 4.49293493 | -4.62331799 | -33.29547928 | -15.55415910 |  |
| 226 | 227 | 228 | 229 | 230 |  |
| 64.94442472 | 33.91146903 | 38.73325066 | 83.78855445 | 84.47738040 |  |
| 231 | 232 | 233 | 234 | 235 |  |
| 60.12264309 | -18.03152775 | 6.91260198 | 31.87146846 | -38.88796449 |  |
| 236 | 237 | 238 | 239 | 240 |  |
| 6.30452072 | 107.76655066 | 194.22952072 | 169.00540577 | 16.42961714 |  |
| 241 | 242 | 243 | 244 | 245 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| -17.15974612 | 16.70452072 | -7.72303476 | 34.80142793 | 2.61468740 |  |
| 246 | 247 | 248 | 249 | 250 |  |
| 51.05616524 | 8.80199441 | 9.49082035 | -8.89383476 | 240.70768419 |  |
| 251 | 252 | 253 | 254 | 255 |  |
| 237.26355445 | 235.19707661 | 207.64403872 | 216.59877604 | -2.79547928 |  |
| 256 | 257 | 258 | 259 | 260 |  |
| 40.05559877 | -7.29547928 | 20.92851335 | -2.37735691 | -9.58266070 |  |
| 261 | 262 | 263 | 264 | 265 |  |
| 113.19688361 | -10.53398665 | 8.74612414 | 16.32320956 | -15.78683154 |  |
| 266 | 267 | 268 | 269 | 270 |  |
| 3.50029498 | -24.73683154 | -20.59103154 | 30.75559877 | -7.29547928 |  |
| 271 | 272 | 273 | 274 | 275 |  |
| 34.88855445 | 53.02229877 | 53.71112472 | 117.65446582 | 90.79025388 |  |
| 276 | 277 | 278 | 279 | 280 |  |
| 94.23438361 | 94.54514251 | 113.22532072 | -4.25500881 | -28.86978723 |  |
| 281 | 282 | 283 | 284 | 285 |  |
| 5.53252035 | 13.10960577 | 29.73517225 | -5.57467928 | 24.58021277 |  |
| 286 | 287 | 288 | 289 | 290 |  |
| 162.91528304 | 165.67058683 | -22.41016128 | -19.84702396 | 54.53855445 |  |
| 291 | 292 | 293 | 294 | 295 |  |
| 31.11847225 | 40.07320956 | 6.22377604 | 18.70452072 | 64.41825009 |  |
| 296 | 297 | 298 | 299 | 300 |  |
| 86.46068040 | 71.30650956 | 45.90452072 | -5.52868286 | -12.54481639 |  |
| 301 | 302 | 303 | 304 | 305 |  |
| -21.23096128 | -11.06659802 | 475.50771335 | 18.45256088 | 21.20786467 |  |
| 306 | 307 | 308 | 309 | 310 |  |
| -27.49213533 | 27.37832035 | 50.10957661 | 85.03529441 | 130.80051714 |  |
| 311 | 312 | 313 | 314 | 315 |  |
| 112.89104251 | 121.15695388 | 164.34612414 | 180.18912093 | 164.34612414 |  |
| 316 | 317 | 318 | 319 | 320 |  |
| -0.62792339 | 13.53649819 | 34.20127661 | 1.70452072 | 100.43381714 |  |
| 321 | 322 | 323 | 324 | 325 |  |
| 2.20452072 | -28.86978723 | 98.12298740 | -9.37735691 | -7.99970502 |  |
| 326 | 327 | 328 | 329 | 330 |  |
| -20.37735691 | -13.61144555 | -19.43322718 | -10.13266070 | -11.51031260 |  |
| 331 | 332 | 333 | 334 | 335 |  |
| -38.97565749 | -13.61144555 | -18.05557528 | -24.51031260 | -21.49970502 |  |
| 336 | 337 | 338 | 339 | 340 |  |
| -35.31770181 | -8.75500881 | 0.19972851 | -5.99970502 | 25.59859556 |  |
| 341 | 342 | 343 | 344 | 345 |  |
| 23.53211772 | 18.02151014 | 1.48968740 | -23.13266070 | -12.80027149 |  |
| 346 | 347 | 348 | 349 | 350 |  |
| -15.55557528 | -17.62205312 | -28.64326828 | -18.31087907 | -16.24440123 |  |
| 351 | 352 | 353 | 354 | 355 |  |
| 15.95503230 | -15.04213533 | -1.26561639 | -0.48909744 | -3.93322718 |  |
| 356 | 357 | 358 | 359 | 360 |  |
| -24.51031260 | -16.93322718 | -28.64326828 | -28.64326828 | 15.71342284 |  |
| 361 | 362 | 363 | 364 | 365 |  |
| -1.62205312 | 1.13325066 | -15.82148665 | -33.29547928 | -12.80027149 |  |
| 366 | 367 | 368 | 369 | 370 |  |
| -17.02092018 | -23.90917965 | -35.03152775 | -12.19913854 | -6.68853097 |  |
| 371 | 372 | 373 | 374 | 375 |  |
| 0.06677282 | -13.70974612 | -6.68853097 | -5.99970502 | -22.18853097 |  |
| 376 | 377 | 378 | 379 | 380 |  |
| -18.99970502 | -18.74440123 | 8.02681393 | -7.81618286 | -7.81618286 |  |
| 381 | 382 | 383 | 384 | 385 |  |
| -17.36674934 | -20.37735691 | -12.29547928 | -15.67792339 | -33.29547928 |  |
| 386 | 387 | 388 | 389 | 390 |  |
| 18.52681393 | 48.38855445 | -9.02622396 | -18.99970502 | -21.75500881 |  |
| 391 | 392 | 393 | 394 | 395 |  |
| 49.07738040 | -4.96773097 | -1.52360123 | 1.56677282 | 48.38855445 |  |
| 396 | 397 | 398 | 399 | 400 |  |
| -2.11144555 | -13.13266070 | -23.90917965 | 14.27681393 | -9.14326828 |  |
| 401 | 402 | 403 | 404 | 405 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| -3.63266070 | -17.45257907 | -19.51905691 | -15.55557528 | -14.17792339 |  |
| 406 | 407 | 408 | 409 | 410 |  |
| -12.11144555 | -14.26561639 | -6.68853097 | -14.61144555 | -24.51031260 |  |
| 411 | 412 | 413 | 414 | 415 |  |
| -33.29547928 | -25.88796449 | -10.82148665 | -17.88796449 | -15.13266070 |  |
| 416 | 417 | 418 | 419 | 420 |  |
| -23.13266070 | 2.26620635 | -20.12205312 | -34.58739802 | -15.67792339 |  |
| 421 | 422 | 423 | 424 | 425 |  |
| -15.67792339 | -15.74440123 | -16.24440123 | -23.13266070 | -20.37735691 |  |
| 426 | 427 | 428 | 429 | 430 |  |
| -35.53152775 | -20.37735691 | 1.32818125 | -14.74440123 | -30.02092018 |  |
| 431 | 432 | 433 | 434 | 435 |  |
| 16.15446582 | 1.00029498 | -44.91978723 | -22.87735691 | 8.71563987 |  |
| 436 | 437 | 438 | 439 | 440 |  |
| -16.08209423 | -17.45974612 | 35.75559877 | 35.75559877 | 18.53495009 |  |
| 441 | 442 | 443 | 444 | 445 |  |
| 19.22377604 | -34.59800559 | 44.25559877 | 38.74499119 | 46.32207661 |  |
| 446 | 447 | 448 | 449 | 450 |  |
| -12.11144555 | -3.48909744 | -17.05557528 | -24.51031260 | -26.90917965 |  |
| 451 | 452 | 453 | 454 | 455 |  |
| -34.15387586 | -17.02092018 | -6.68853097 | 46.32207661 | -28.64326828 |  |
| 456 | 457 | 458 | 459 | 460 |  |
| -30.10861317 | -28.04213533 | -23.16883476 | -13.92261960 | -14.64326828 |  |
| 461 | 462 | 463 | 464 | 465 |  |
| -2.24440123 | -30.08739802 | 2.25559877 | 3.63325066 | -24.25500881 |  |
| 466 | 467 | 468 | 469 | 470 |  |
| -14.76387528 | -10.13266070 | -3.24440123 | -6.86674934 | -20.94547928 |  |
| 471 | 472 | 473 | 474 | 475 |  |
| -24.47148665 | -30.20974612 | -39.62565749 | -33.29547928 | -23.56618286 |  |
| 476 | 477 | 478 | 479 | 480 |  |
| -4.62205312 | -7.37735691 | -22.58717928 | 28.17779556 | 26.80014366 |  |
| 481 | 482 | 483 | 484 | 485 |  |
| 11.64597282 | 13.71245066 | -12.42261960 | -0.29547928 | -25.63266070 |  |
| 486 | 487 | 488 | 489 | 490 |  |
| -24.63531260 | -18.74440123 | -42.38096128 | -21.15387586 | -15.64326828 |  |
| 491 | 492 | 493 | 494 | 495 |  |
| -41.47565749 | -18.24967928 | 23.60279556 | 2.93801714 | 7.75979877 |  |
| 496 | 497 | 498 | 499 | 500 |  |
| -17.71627928 | -20.37735691 | -24.26561639 | -21.25500881 | -20.37735691 |  |
| 501 | 502 | 503 | 504 | 505 |  |
| -18.39857207 | -2.16731581 | -21.45444233 | -15.30027149 | -26.57679044 |  |
| 506 | 507 | 508 | 509 | 510 |  |
| -32.77622396 | -50.43039480 | -18.31087907 | -35.90917965 | -13.57679044 |  |
| 511 | 512 | 513 | 514 | 515 |  |
| -13.23379365 | -45.73228723 | -5.02862178 | 7.71465824 | 11.90976961 |  |
| 516 | 517 | 518 | 519 | 520 |  |
| 11.22094366 | -11.85472557 | -17.62205312 | 10.94972851 | -18.49970502 |  |
| 521 | 522 | 523 | 524 | 525 |  |
| -12.62659744 | -22.18853097 | -26.57679044 | -17.36674934 | -19.43297928 |  |
| 526 | 527 | 528 | 529 | 530 |  |
| -18.05557528 | -18.83023097 | -21.49970502 | -33.29547928 | -21.15387586 |  |
| 531 | 532 | 533 | 534 | 535 |  |
| -15.30027149 | -18.24547928 | -27.95444233 | -6.17792339 | 0.19972851 |  |
| 536 | 537 | 538 | 539 | 540 |  |
| -21.33209423 | -21.75500881 | -23.13266070 | -20.63985691 | -16.27757907 |  |
| 541 | 542 | 543 | 544 | 545 |  |
| 11.90976961 | 7.77681393 | -9.44383476 | -27.01031260 | -15.13266070 |  |
| 546 | 547 | 548 | 549 | 550 |  |
| -12.37735691 | -18.99970502 | -13.50977528 | 5.46342284 | 3.97094366 |  |
| 551 | 552 | 553 | 554 | 555 |  |
| -10.49440123 | -36.65387586 | -15.30027149 | -16.67792339 | -17.62205312 |  |
| 556 | 557 | 558 | 559 | 560 |  |
| -16.93322718 | -5.31087907 | -3.93322718 | -12.11144555 | 10.26090256 |  |
| 561 | 562 | 563 | 564 | 565 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| -20.37735691 | -39.85330938 | -21.02735691 | -26.32148665 | -27.26561639 |  |
| 566 | 567 | 568 | 569 | 570 |  |
| -16.93322718 | -25.90864233 | -19.43322718 | -12.45585852 | 42.64385824 |  |
| 571 | 572 | 573 | 574 | 575 |  |
| -36.65387586 | -15.55557528 | -19.34970502 | -20.81087907 | -11.68853097 |  |
| 576 | 577 | 578 | 579 | 580 |  |
| -10.31087907 | -27.26561639 | -13.06618286 | -12.37735691 | -18.05557528 |  |
| 581 | 582 | 583 | 584 | 585 |  |
| -13.06618286 | -33.29547928 | -5.22848986 | -24.51561639 | -22.09942178 |  |
| 586 | 587 | 588 | 589 | 590 |  |
| -5.31087907 | -6.68853097 | 8.90976961 | 7.53211772 | -9.68853097 |  |
| 591 | 592 | 593 | 594 | 595 |  |
| 14.40597476 | 11.59329177 | -9.76031260 | -7.69383476 | -47.67509101 |  |
| 596 | 597 | 598 | 599 | 600 |  |
| -20.42047928 | -21.06618286 | -20.29547928 | -17.12205312 | -16.24440123 |  |
| 601 | 602 | 603 | 604 | 605 |  |
| -34.09326828 | -1.41731581 | -3.48379365 | -16.57148665 | -16.08379365 |  |
| 606 | 607 | 608 | 609 | 610 |  |
| -22.28322718 | -18.56409744 | -17.88224555 | -26.12735691 | -22.57205312 |  |
| 611 | 612 | 613 | 614 | 615 |  |
| -30.79061639 | -3.93657716 | -15.76144555 | -11.83455312 | -22.73455312 |  |
| 616 | 617 | 618 | 619 | 620 |  |
| -18.56409744 | -22.19440123 | -22.88322718 | -28.77148665 | -16.81144555 |  |
| 621 | 622 | 623 | 624 | 625 |  |
| -12.23000881 | -17.94607149 | 15.80711772 | 14.42946582 | 17.18476961 |  |
| 626 | 627 | 628 | 629 | 630 |  |
| -16.49761960 | -31.11296449 | 12.36298798 | 10.98533608 | -8.30179044 |  |
| 631 | 632 | 633 | 634 | 635 |  |
| -23.51507907 | -22.84705312 | -8.30179044 | -18.63489744 | -22.72625312 |  |
| 636 | 637 | 638 | 639 | 640 |  |
| -12.13322718 | -7.31144555 | -21.46940123 | -29.77148665 | 15.23079177 |  |
| 641 | 642 | 643 | 644 | 645 |  |
| 12.47548798 | 16.60844366 | 9.72018419 | 15.23079177 | -8.87811639 |  |
| 646 | 647 | 648 | 649 | 650 |  |
| -20.75977528 | -7.50046449 | -36.48474612 | -19.95292339 | -21.50557528 |  |
| 651 | 652 | 653 | 654 | 655 |  |
| -9.96431960 | -26.15235691 | -20.70137528 | -14.43811581 | -19.26409744 |  |
| 656 | 657 | 658 | 659 | 660 |  |
| -18.90500881 | -19.59383476 | 6.02910204 | 6.02910204 | 3.10159177 |  |
| 661 | 662 | 663 | 664 | 665 |  |
| -9.98610123 | -17.06144555 | -33.04061639 | -22.72625312 | -19.25989744 |  |
| 666 | 667 | 668 | 669 | 670 |  |
| -22.84705312 | -18.51674934 | -26.06627928 | -22.47659744 | 21.74079119 |  |
| 676 | 677 | 678 | 679 | 680 |  |
| -19.40292339 | -17.36144555 | -22.72625312 | -1.59973418 | -3.66621202 |  |
| 681 | 682 | 683 | 684 | 685 |  |
| -26.07047928 | -18.04967928 | -25.54547928 | -24.76561639 | -19.25500881 |  |
| 686 | 687 | 688 | 689 | 690 |  |
| -11.07792339 | -20.14174934 | -18.63489744 | -25.64273097 | -20.61674934 |  |
| 691 | 692 | 693 | 694 | 695 |  |
| -20.07094934 | -28.77148665 | -18.17255852 | -19.35712339 | -19.05027149 |  |
| 696 | 697 | 698 | 699 | 700 |  |
| -17.23224555 | -18.51542339 | -24.71485691 | -16.44894555 | -30.22546449 |  |
| 701 | 702 | 703 | 704 | 705 |  |
| -15.76011960 | -15.76011960 | -19.42792339 | -19.42792339 | -19.12792339 |  |
| 706 | 707 | 708 | 709 | 710 |  |
| -18.83717928 | -18.83717928 | -24.20390502 | -21.39020123 | -15.98379365 |  |
| 711 | 712 | 713 | 714 | 715 |  |
| -30.44913854 | -24.74970502 | -21.19440123 | -19.44462339 | 21.74079119 |  |
| 716 | 717 | 718 | 719 | 720 |  |
| -24.63853097 | -16.16785312 | -10.65724555 | -19.43909744 | -17.06144555 |  |
| 721 | 722 | 723 | 724 | 725 |  |
| -21.99440123 | -30.01451260 | -21.74860123 | -26.33288286 | -26.31618286 |  |
| 726 | 727 | 728 | 729 | 730 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| -20.11674934 | -25.74815691 | -53.52480778 | -34.28209423 | -28.92568665 |  |
| 731 | 732 | 733 | 734 | 735 |  |
| -23.41507907 | -17.90447149 | -25.32735691 | -3.01201202 | 1.12094366 |  |
| 736 | 737 | 738 | 739 | 740 |  |
| -21.61031260 | -46.10330938 | -17.64197149 | -8.32261960 | -26.92092018 |  |
| 741 | 742 | 743 | 744 | 745 |  |
| -15.76011960 | -20.98616231 | -35.65974612 | -17.35004934 | -15.62947149 |  |
| 746 | 747 | 748 | 749 | 750 |  |
| -26.42735691 | -24.93853097 | 1.45783582 | -21.73266070 | -17.59970502 |  |
| 751 | 752 | 753 | 754 | 755 |  |
| -23.41507907 | -22.03742718 | -5.09440123 | -19.81674934 | -3.02792339 |  |
| 756 | 757 | 758 | 759 | 760 |  |
| -16.37261960 | -17.19547928 | -17.19547928 | -20.45472557 | -20.11031260 |  |
| 761 | 762 | 763 | 764 | 765 |  |
| -23.87735691 | -14.23379365 | 7.17359556 | 7.74759422 | -10.04705312 |  |
| 766 | 767 | 768 | 769 | 770 |  |
| -14.86883476 | -22.03742718 | -25.39967928 | -25.39967928 | -20.61674934 |  |
| 771 | 772 | 773 | 774 | 775 |  |
| -30.26031260 | -17.92107149 | -16.52681960 | -32.98076828 | -34.43629423 |  |
| 776 | 777 | 778 | 779 | 780 |  |
| -26.06627928 | -27.00500881 | -17.75027149 | -20.90235691 | -21.49440123 |  |
| 781 | 782 | 783 | 784 | 785 |  |
| -20.50557528 | -27.54803476 | -49.73626507 | -21.69440123 | -14.65557528 |  |
| 786 | 787 | 788 | 789 | 790 |  |
| -13.96674934 | -17.33644555 | -15.95879365 | -36.73474612 | -26.07047928 |  |
| 791 | 792 | 793 | 794 | 795 |  |
| -32.34759044 | -17.19341960 | -15.81576770 | -37.83739802 | -3.68170823 |  |
| 796 | 797 | 798 | 799 | 800 |  |
| -26.07047928 | -25.51002936 | -32.86002936 | -26.24547928 | -17.31564555 |  |
| 801 | 802 | 803 | 804 | 805 |  |
| -25.54547928 | -25.54547928 | -26.34547928 | -22.74285312 | -25.54547928 |  |
| 806 | 807 | 808 | 809 | 810 |  |
| 23.20032072 | 7.19707661 | 15.46298798 | -25.24547928 | 9.26355445 |  |
| 811 | 812 | 813 | 814 | 815 |  |
| 10.64120635 | -11.40122396 | -25.54547928 | -26.04547928 | -22.19152718 |  |
| 816 | 817 | 818 | 819 | 820 |  |
| -18.79547928 | -25.39967928 | -19.81674934 | -16.00049365 | -25.54547928 |  |
| 821 | 822 | 823 | 824 | 825 |  |
| 1.61298798 | -14.91883476 | -33.10444233 | -13.54118286 | -31.83796449 |  |
| 826 | 827 | 828 | 829 | 830 |  |
| 27.98798798 | 33.49859556 | 26.61033608 | 27.29916203 | 23.16620635 |  |
| 831 | 832 | 833 | 834 | 835 |  |
| 24.54385824 | 6.63438361 | 4.56790577 | -39.79270181 | -26.39250881 |  |
| 836 | 837 | 838 | 839 | 840 |  |
| -25.24547928 | -16.64329744 | -30.27413854 | -24.07470502 | -18.02527149 |  |
| 841 | 842 | 843 | 844 | 845 |  |
| -20.39440123 | -16.68931960 | -13.32877928 | -13.32877928 | -16.14970502 |  |
| 846 | 847 | 848 | 849 | 850 |  |
| -13.39440123 | -16.98909744 | -21.67078826 | -26.84614233 | -22.76785312 |  |
| 851 | 852 | 853 | 854 | 855 |  |
| -19.32372339 | -29.60144612 | -25.74547928 | -22.68322718 | -26.43717928 |  |
| 856 | 857 | 858 | 859 | 860 |  |
| -1.50216392 | -25.54547928 | -24.33587907 | 23.20032072 | -18.36144555 |  |
| 861 | 862 | 863 | 864 | 865 |  |
| -22.69705312 | -20.63057528 | -18.90424934 | -24.10390502 | -24.22470502 |  |
| 866 | 867 | 868 | 869 | 870 |  |
| -25.54547928 | -1.80273039 | -15.57924934 | -35.88209423 | -9.47470502 |  |
| 871 | 872 | 873 | 874 | 875 |  |
| -23.38587907 | -25.54547928 | -25.24547928 | -33.99326828 | -25.40797928 |  |
| 876 | 877 | 878 | 879 | 880 |  |
| -26.14815691 | -25.39967928 | -23.38587907 | -22.00822718 | -25.39967928 |  |
| 881 | 882 | 883 | 884 | 885 |  |
| -24.79273097 | -19.38212339 | -26.24547928 | -18.63489744 | -37.92202396 |  |
| 886 | 887 | 888 | 889 | 890 |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| -17.36841960 | -25.54547928 | -25.18297928 | -29.63686070 | -22.84705312 |  |
| 891 | 892 | 893 | 894 | 895 |  |
| -20.07094934 | -26.78963476 | -26.29118286 | -24.83433097 | -4.33458228 |  |
| 896 | 897 | 898 | 899 | 900 |  |
| -2.26810444 | -46.46504991 | -27.66883476 | -25.80027149 | -20.17757907 |  |
| 901 | 902 | 903 | 904 | 905 |  |
| -9.84547928 | -9.84547928 | -9.84547928 | -9.84547928 | -20.65977528 |  |
| 906 | 907 | 908 | 909 | 910 |  |
| -26.90080881 | -23.45667907 | -16.66409744 | -17.35292339 | -26.83000881 |  |
| 911 | 912 | 913 | 914 | 915 |  |
| -17.29761960 | -18.74462339 | -25.48155691 | -19.38212339 | -27.58963476 |  |
| 916 | 917 | 918 | 919 | 920 |  |
| -20.34594934 | -2.05118228 | -26.16009044 | -26.06627928 | -18.22665852 |  |
| 921 | 922 | 923 | 924 | 925 |  |
| -25.54547928 | -26.04547928 | -25.54547928 | -25.54547928 | -28.64787368 |  |
| 926 | 927 | 928 | 929 | 930 |  |
| -34.97092018 | -25.54547928 | -18.84127928 | -18.84127928 | -25.54547928 |  |
| 931 | 932 | 933 | 934 | 935 |  |
| -25.54547928 | -25.55797928 | -19.20424934 | -21.95955312 | 6.55711772 |  |
| 936 | 937 | 938 | 939 | 940 |  |
| -10.66353097 | -8.59705312 | -1.21810444 | -17.25724555 | -25.32701260 |  |
| 941 | 942 | 943 | 944 | 945 |  |
| -25.39967928 | -22.70402718 | -26.07047928 | -28.61163854 | -25.39967928 |  |
| 946 | 947 | 948 | 949 | 950 |  |
| 23.20032072 | 23.20032072 | -20.61674934 | -25.54547928 | 25.87374688 |  |
| 951 | 952 | 953 | 954 | 955 |  |
| -23.20523097 | -24.91353097 | -20.09174934 | -20.64174934 | -7.82877928 |  |
| 956 | 957 | 958 | 959 | 960 |  |
| -7.82877928 | -7.82877928 | -7.82877928 | -7.82877928 | -26.83000881 |  |
| 961 | 962 | 963 | 964 | 965 |  |
| -30.03957368 | -17.79547928 | -17.79547928 | -37.51031260 | -15.42679044 |  |
| 966 | 967 | 968 | 969 | 970 |  |
| -19.74440123 | -22.15822718 | -35.95974612 | -21.96031260 | -17.82735691 |  |
| 971 | 972 | 973 | 974 | 975 |  |
| -18.56409744 | -25.41627928 | 24.49609498 | -25.74547928 | -17.27735691 |  |
| 976 | 977 | 978 | 979 | 980 |  |
| -14.52205312 | -25.41627928 | -19.58351041 | -22.64837907 | -40.78850181 |  |
| 981 | 982 | 983 | 984 | 985 |  |
| -20.70137528 | -27.17580881 | -25.39967928 | -25.74547928 | -25.54547928 |  |
| 986 | 987 | 988 | 989 | 990 |  |
| -22.10270123 | -20.74174934 | -25.41627928 | -25.54547928 | -25.24547928 |  |
| 991 | 992 | 993 | 994 | 995 |  |
| -24.76353097 | -26.06627928 | -25.97176989 | -25.55797928 | -26.06627928 |  |
| 996 | 997 | 998 | 999 | 1000 |  |
| -28.92568665 | -27.54803476 | -26.07047928 | -25.39967928 | -25.54547928 |  |

|  |  |
| --- | --- |
| * #parameter's to evaluate linear model |  |
| * MSE = mean((DIFF)^2) #mean square error |
| * MSE |
| [1] 2596.174 |
| * MAE = mean(abs(DIFF)) #mean absolute error |
| * MAE |
| [1] 29.4845 |
| * RMSE = sqrt(MSE) #root mean square error |
| * RMSE |
| [1] 50.95266 |
| * R\_2 = 1 - (sum((DIFF)^2) / sum((DF$fare - mean(DF$fare))^2)) |
| * R\_2 |
| [1] 0.0294193 |
| >cat("MAE:",MAE,"\n", "MSE:", MSE,"\n", "RMSE: ", RMSE,"\n", "R-squared:", | R\_2) |
| MAE: 29.4845 |  |
| MSE: 2596.174 |  |
| RMSE: 50.95266 |  |
| R-squared: 0.0294193 |  |