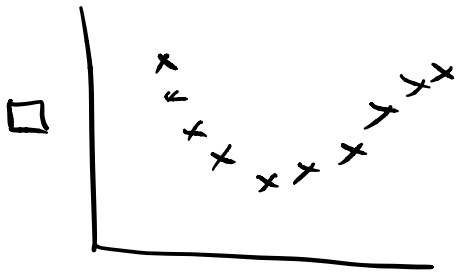
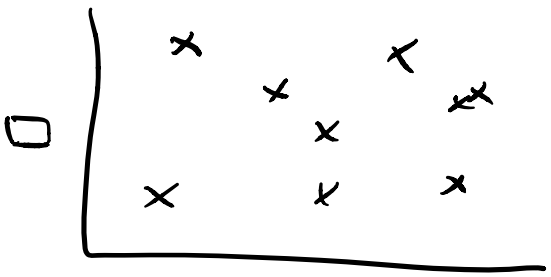
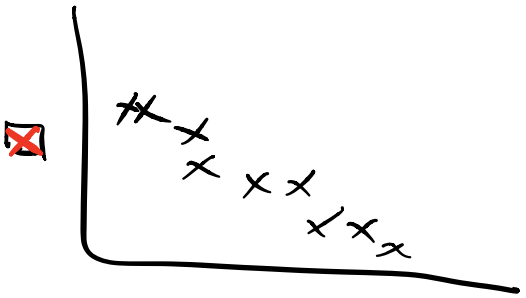
## PROBLEM #1

Which plots would a linear fit make sense for

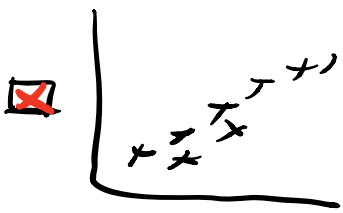


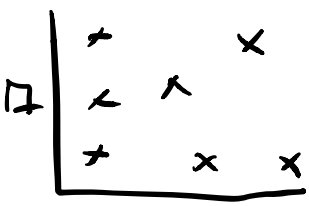




## PROBLEM #2.

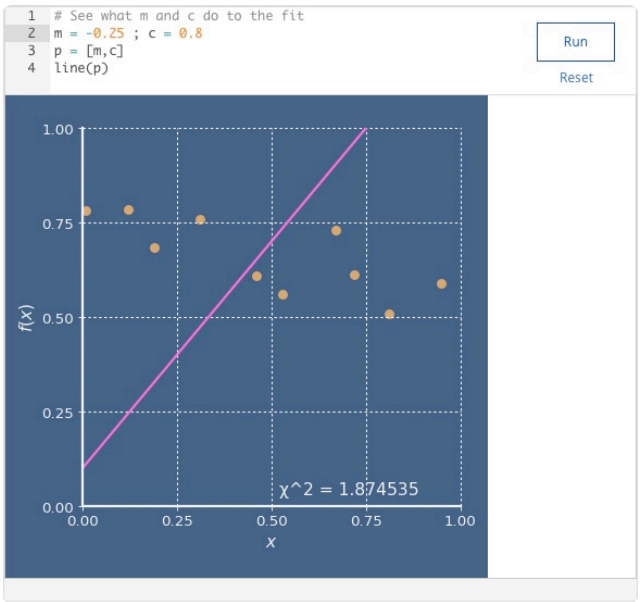
Which plots would make sense for a linear fit.





## PROBLEM #3

Find reasonably optimal parameters for $m$ and $c$.

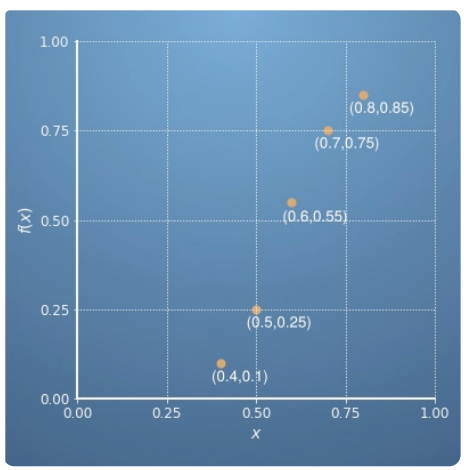



$m = -0.27$

$c = 0.8$

## PROBLEM #4

Use a linear model and gradients to form a minimization problem, use the minimization formula to find the parameters $m$ and $c$ which best fit the five points below.




The Chi-squared test can be used to check goodness of fit,

$$\chi^2 = \sum_i (y_i - mx_i - c)^2$$

By forming a Lagrangian, then formulating it's gradient $\nabla L$, then solving the system of equations can find general solutions for the parameters $m$ and $c$.

$$m = \frac{\sum_i (x_i - \bar{x}) y_i}{\sum_i (x_i - \bar{x})^2} \qquad c = \bar{y} - m\bar{x}$$

$$\bar{x} = (0.4 + 0.5 + 0.6 + 0.7 + 0.8) \times 5^{-1}$$

$$= 0.6$$

$$\bar{y} = (0.1 + 0.25 + 0.55 + 0.75 + 0.85) \times 5^{-1}$$

$$= 0.5$$

$$m = \frac{\overset{-0.02}{(0.4-0.6)\times 0.1} + \overset{-0.025}{(0.5-0.6)\times 0.25} + \overset{0}{(0.6-0.6)0.55} + \overset{0.075}{(0.7-0.6)\times 0.75} + \overset{0.17}{(0.8-0.6)0.85}}{\underset{0.04}{(0.4-0.6)^2} + \underset{0.01}{(0.5-0.6)^2} + (0.6-0.6)^2 + \underset{0.01}{(0.7-0.6)^2} + \underset{0.04}{(0.8-0.6)^2}} \quad \overset{.2}{=} \frac{2}{1}$$

$$= 2$$

$$c = 0.5 - (m)0.6$$

$$= 0.5 - 2(0.6)$$

$$= -0.7$$

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## PROBLEM #5

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Implement linear fit.

```
# Here the function is defined
def linfit(xdat,ydat):
  # Here xbar and ybar are calculated
  xbar = np.sum(xdat)/len(xdat)
  ybar = np.sum(ydat)/len(ydat)

  # Insert calculation of m and c here. If nothing is here the data will
      be plotted with no linear fit
  xdelta = [delta - xbar for delta in xdat]
  m = np.sum([x*y for x,y in zip(xdelta, ydat)]) / np.sum([s**2 for s in
      xdelta])
  c = ybar - m*xbar

  # Return your values as [m, c]
  return [m, c]

# Produce the plot - don't put this in the next code block
line()
```

Run

Reset

# PROBLEM #6

Use stats.lingress(xdat, ydat)

```
1  from scipy import stats
2
3  # Use the stats.linregress() method to evaluate regression
4  regression = stats.linregress(xdat, ydat)
5
6  line(regression)
```

Run

Reset