③ a. An agent is risk averse if:

$$\cancel{u(EV(y)) > EU(y)}$$

$$\cancel{u\left(\sum p_i x_i\right) > \sum p_i u(x_i)}$$

$$u(E[y]) > E[u(y)]$$

By Jensens inequality, this is true if $u(y)$ is strictly concave.

$$u'(y) = \frac{1}{y}$$

$$u''(y) = -\frac{1}{y^2} < 0$$ so Charlie is risk averse

B. $$A(y) = -\frac{u''(y)}{u'(y)} = -\frac{-1/y^2}{1/y} = \frac{1}{y}$$

So DARA

$$R(y) = A(y)y = \frac{1}{y}y = 1$$

So it is CRRA(1)

c. Success: $10+c$
Failure: $10-\frac{1}{2}c$

$$L=\left[\frac{1}{2},\frac{1}{2};\ 10+c,\ 10-\frac{1}{2}c\right]$$

$$\max_c EU = \sum P_i\, U(x_i) = \frac{1}{2}\ln(10+c)+\frac{1}{2}\ln\left(10-\frac{1}{2}c\right)$$

FOC:

$$\frac{dEU}{dc} = \frac{1}{2}\cdot\frac{1}{10+c} + \frac{1}{2}\cdot -\frac{1}{2}\cdot\frac{1}{10-\frac{1}{2}c} = 0$$

$$\frac{1}{20+2c} - \frac{1}{40-2c} = 0$$

$$20+2c = 40-2c$$

$$4c = 20$$

$$c = 5$$

d. $$L_{20}=\left[\frac{1}{2},\frac{1}{2};\ 20+c,\ 20-\frac{1}{2}c\right]$$

$$\max_c EU = \frac{1}{2}\ln(20+c)+\frac{1}{2}\ln\left(20-\frac{1}{2}c\right)$$

FOC

$$\frac{dEU}{dc} = \frac{1}{2}\cdot\frac{1}{20+c} + \frac{1}{2}\cdot -\frac{1}{2}\cdot\frac{1}{20-\frac{1}{2}c} = 0$$

$$\frac{1}{40+2c} - \frac{1}{80-2c} = 0$$

$$4c = 40$$

$$c = 10$$

So she invests double the amount, which makes sense because her absolute risk aversion has halved, from $\frac{1}{10}$ to $\frac{1}{20}$. And given relative risk aversion is constant, she invests a constant portion of her initial wealth, namely a half.

You can argue it with both relative and absolute risk aversion does not matter which one you argue it with

(4)

a. She ~~is~~ is risk averse with increasing and strictly concave utility so:

$$u'(y) > 0 \quad \text{and} \quad u''(y) < 0$$

~~Since~~ So $u'(w-L) > u'(w)$

b. The price of the coverage equals the probability of the accident, so the insurer's expected profit is 0 and Perdita's expected value stays the same.

c. $\max_q EU = \pi \cdot u(w - L - pq + q) + (1-\pi)\,u(w - pq)$

FOC:

$$\frac{dEU}{dq} = \pi(1-p)\,u'(w - L + (1-p)q^*) - (1-\pi)p\,u'(w - pq^*) = 0$$

d. if $p = \pi$ then

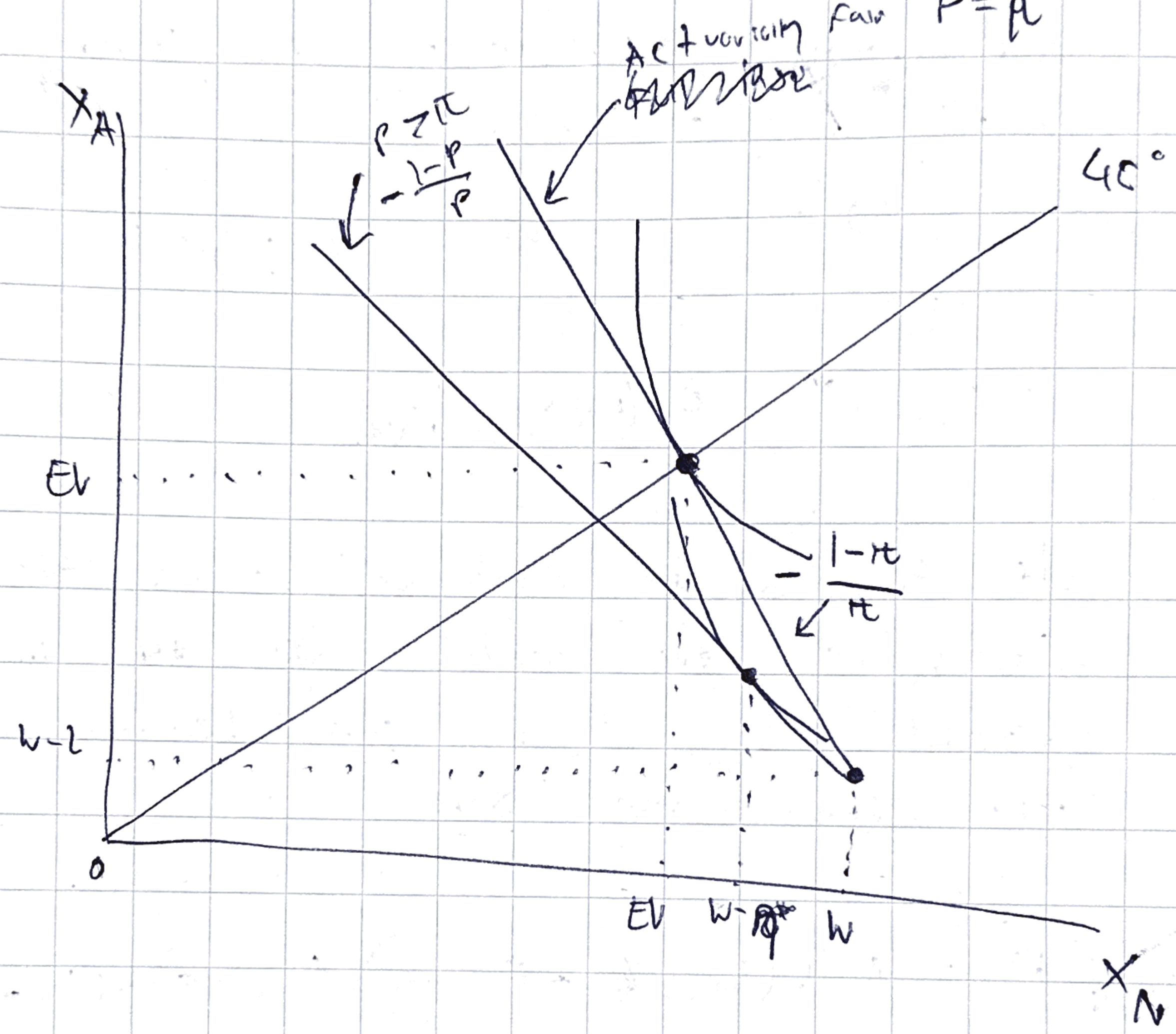
$$u'(w - pq^*) = u'(w - L + (1-p)q^*)$$

$$w - pq^* = w - L + (1-p)q^*$$

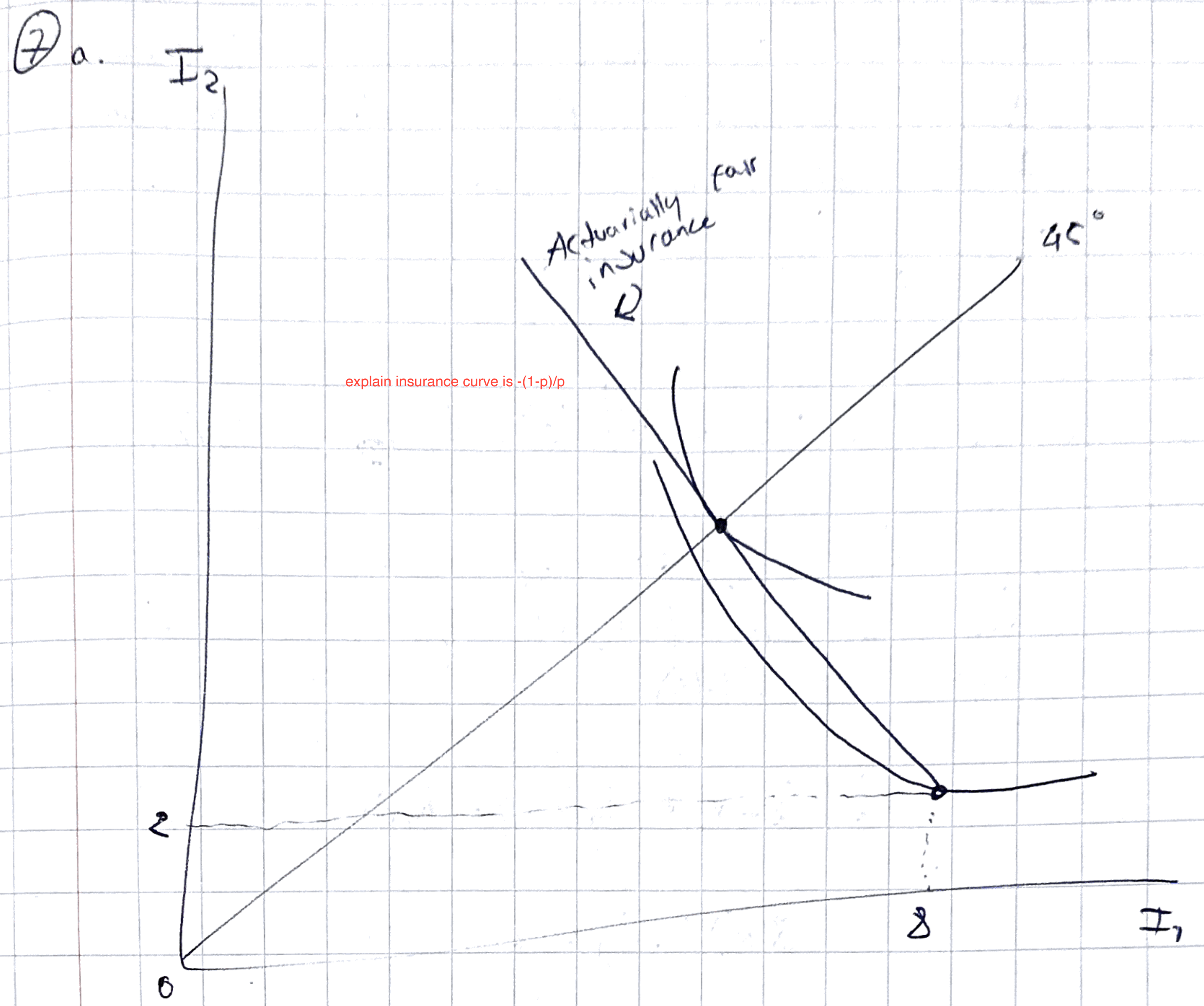
$$q^* = L$$ so she chooses full insurance

e. if $p > \pi$, $u'(w - L + (1-p)q^*) > u'(w - pq^*)$

so $q^* < L$ so she buys less than full insurance



7 a.



B. She is risk neutral so they are straight lines. Her expected income is $\frac{3+7}{2} = 5$ so, as she is risk neutral, any contract where she ends up with an expected income of 5, she would accept.

Since Arthur is risk averse, he will want to smooth his incomes so that $I_1 = I_2$

$$8 - x = 2 + y$$

where x is the transfer from Arthur if state 1 occurs and y the transfer from Norma

If State 2 occurs. $x = y$ since ~~[illegible]~~ Norma's expected payoff has to remain the same so

$$x = y = 3$$

c. Arthur's $EU = \frac{1}{2}\ln(8) + \frac{1}{2}\ln(2) = \ln(4)$

Good, can also just do this by finding the Certainty Equivalent for Arthur

So he will be okay with anything that is at least on his indifference curve where $EU = \ln(4)$:

$$\frac{1}{2}\ln(8-x) + \frac{1}{2}\ln(2+y) = \ln(4)$$

$$(8-x)(2+y) = 16$$

Norma is ~~[illegible]~~ then solving:

$$\max_{x,y} \; EU_N = 5 + \frac{1}{2}(x-y) \quad \text{s.t. } (8-x)(2+y) = 16$$

$$L = 5 + \frac{1}{2}(x-y) - \lambda\Big((8-x)(2+y) - 16\Big)$$

FOC:

$$\frac{\partial L}{\partial x} = \frac{1}{2} - \lambda \cdot -(2+y) = 0 \qquad (1)$$

$$\frac{\partial L}{\partial y} = -\frac{1}{2} - \lambda(8-x) = 0 \qquad (2)$$

12

-(1) / (2) :

$$\frac{1}{2} / -\frac{1}{2} = \frac{-2+y}{8-x}$$

$$\cancel{4}\ 8-x = 2+y$$

Substituting into BC:

$$(2+y)^2 = 16$$

$$2+y = 4$$

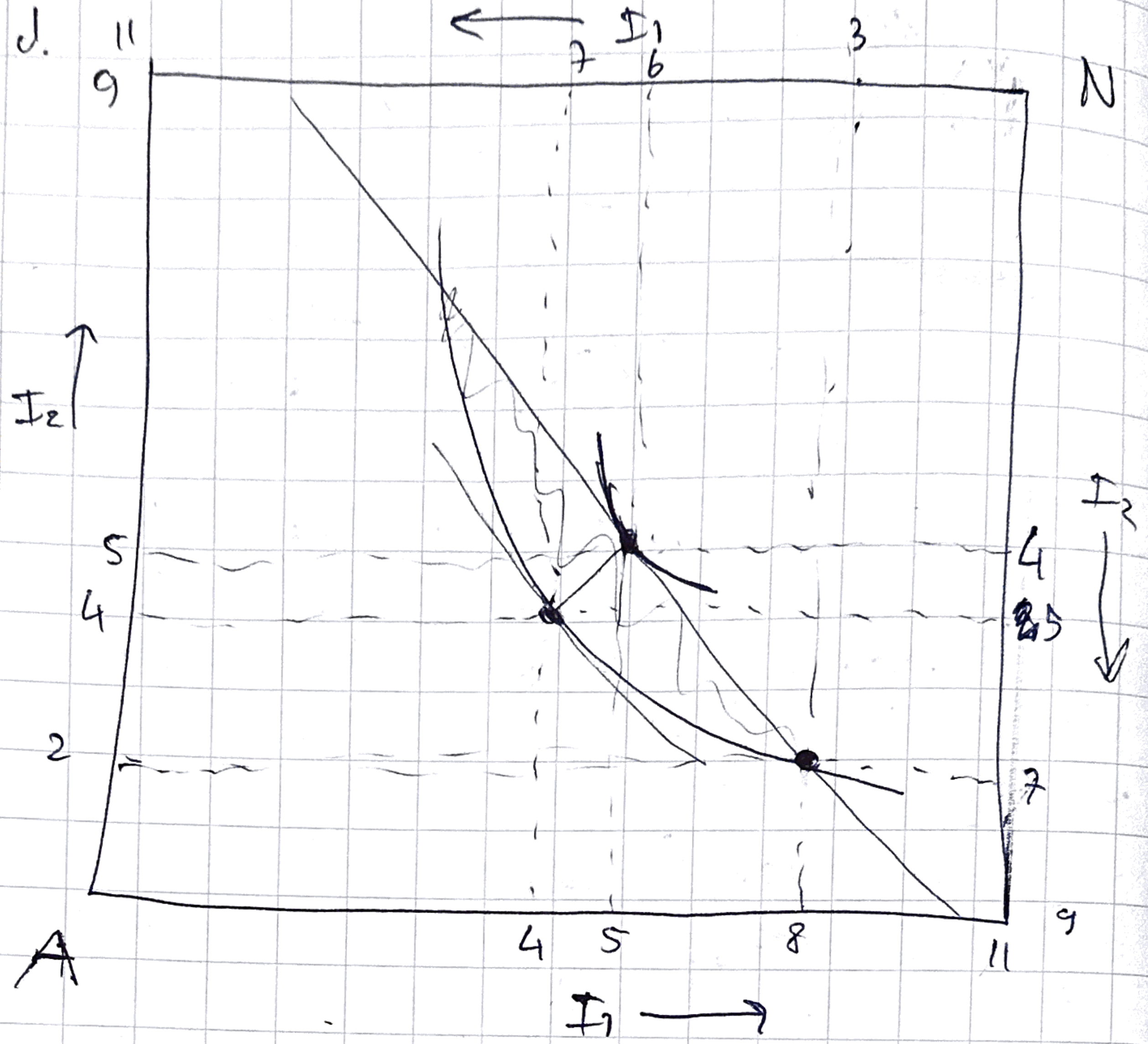
$$y = 2$$

and $8-x = 2+2$

$$x = 4$$

M.

d.



(9) a. $L = [\frac{1}{2}, \frac{1}{2}; 40, 10]$

$EU = \frac{1}{2}\ln(40) + \frac{1}{2}\ln(10) = \ln(20)$

$\ln(CE) = \ln(20)$

$CE = 20$

$EV = \frac{1}{2} \cdot 40 + \frac{1}{2} \cdot 10 = 25$

$RP = EV - CE = 5$

22 > CE so he is better off holding his money

B.

$$L = [\tfrac{1}{2}, \tfrac{1}{2}; 31, 16]$$

$$EU = \tfrac{1}{2}\ln(31) + \tfrac{1}{2}\ln(16) = \ln(22.27)$$

$$\ln(CE) = \ln(22.27)$$

$CE = 22.27 > 22$ so he should take the offer.

C. there is total payoff

Bill's project

		Success	Fail
Bea's project	S	80	50
	F	50	20

So for each of them, L is:

$$L = [\tfrac{1}{4}, \tfrac{1}{4}, \tfrac{1}{2}; 10, 40, 25]$$

$$EU = \tfrac{1}{4}\ln(10) + \tfrac{1}{4}\ln(40) + \tfrac{1}{2}\ln(25) = \ln(22.36)$$

$\Rightarrow CE = 22.36 > 22$ so they should pool their risks.

d. No, the utility function has constant relative risk aversion (CRRA(?))