S1 JAN 09

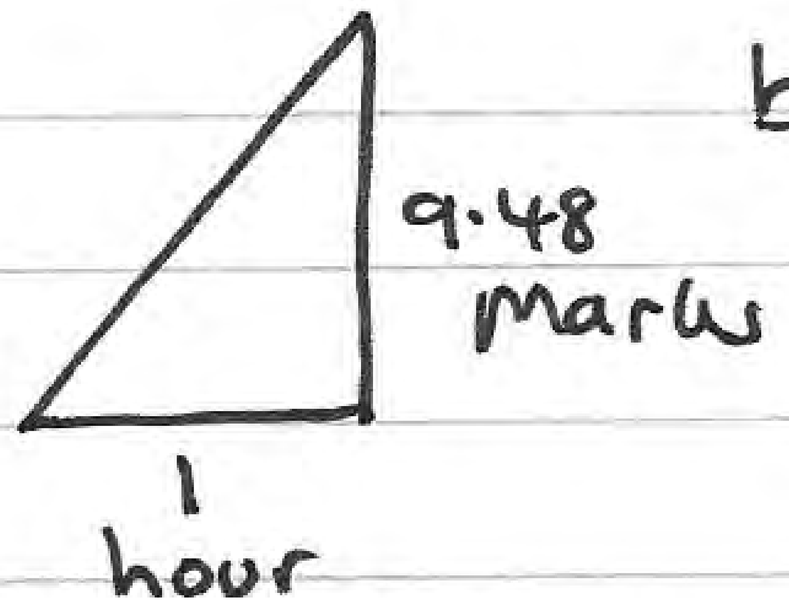
1) $S_{xx} = 57.22 - 21.4^2 \div 10 = 11.424$

$S_{xy} = 313.7 - 21.4 \times 96 \div 10 = 108.26$

b) $\frac{S_{xy}}{S_{xx}} = b = \frac{108.26}{11.424} = 9.47654... = 9.48$ (3sf)

$a = \bar{y} - b\bar{x} = 9.6 - 9.47654... \times 2.14 = -10.679796... = -10.7$ (3sf)

$y = -10.7 + 9.48x$

c) 

$b = \frac{9.48}{1}$

students improve by 9.48 marks for each additional hour of revision.

d) $y = -10.6797... + 9.47654... \times 3.3 = \underline{20.6}$ (3sf)

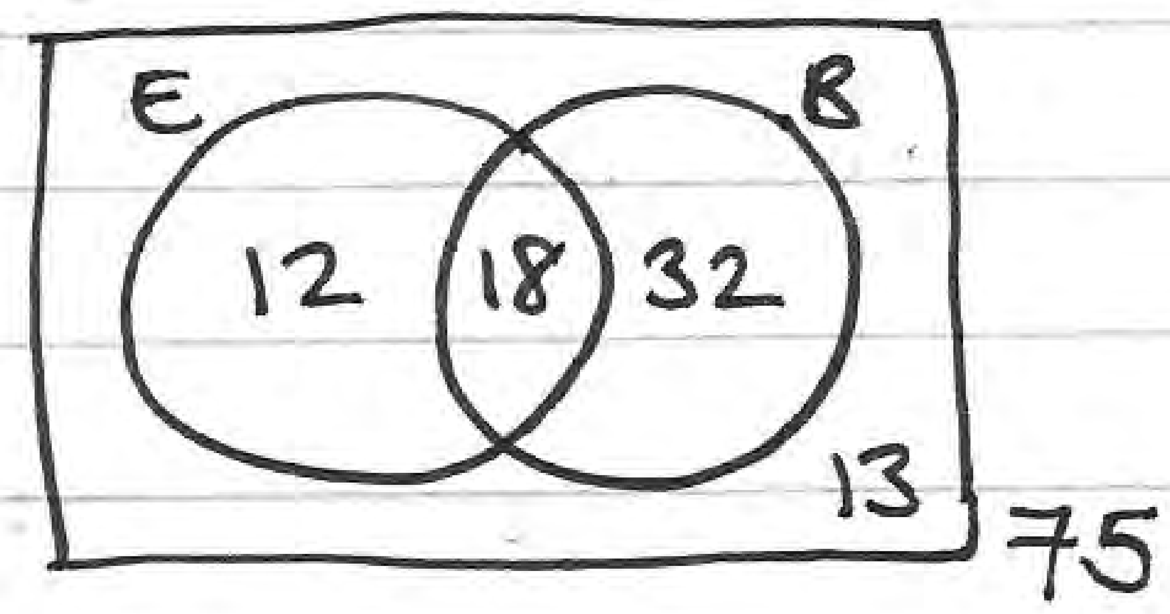
e) unreliable, extrapolation, no evidence to support a prediction of 8 hours.

2) $P(E) = \frac{2}{5}$ $P(B) = \frac{2}{3}$ $P(E|B) = \frac{9}{25}$

a) $P(E|B) = \frac{P(E \cap B)}{P(B)} \Rightarrow \frac{9}{25} = \frac{P(E \cap B)}{\frac{2}{3}} \Rightarrow P(E \cap B) = \frac{9}{25} \times \frac{2}{3} = \frac{18}{75}$

b) $P(E \cap B) = \frac{18}{75}$ $P(E) = \frac{30}{75}$ $P(B) = \frac{50}{75}$

$P(E' \cap B') = \frac{13}{75}$



c) Independent if $P(E \cap B) = P(E) \times P(B)$

$\frac{18}{75} \neq \frac{2}{5} \times \frac{2}{3} = \frac{4}{15} = \frac{20}{75}$ $\therefore$ NOT independent.

3) $E(X) = 0 + 1\times0.3 + 2\times0.2 + 3\times0.1 = 1$

b) $F(1.5) = P(0) + P(1) = 0.4 + 0.3 = 0.7$

c) $E(X^2) = 0^2\times0.4 + 1^2\times0.3 + 2^2\times0.2 + 3^2\times0.1 = 2$

$V(X) = E(X^2) - E(X)^2 = 2 - 1^2 = 1$ #

d) $V(5-3X) = (-3)^2 V(X) = 9\times1 = 9$

e) He needs 4 or more points from the final two game to win

game 4	game 5	
3	3	$= 0.1\times0.1 = 0.01$
3	2	$= 0.1\times0.2 = 0.02$
2	3	$= 0.2\times0.1 = 0.02$
3	1	$= 0.1\times0.3 = 0.03$
1	3	$= 0.3\times0.1 = 0.03$
2	2	$= 0.2\times0.2 = 0.04$

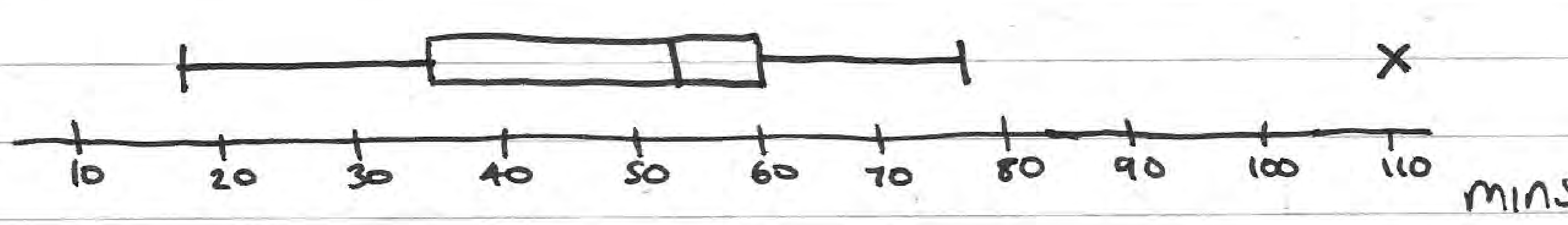
$+ \Rightarrow 0.15$

4) 17 23 35 36 51 53 54 55 60 77 110

$Q_1 = 35$, $Q_2 = 53$, $Q_3 = 60$

b) lower limit $= 35 - 1.5\times(60-35) = -2.5$, no outlier
Upper limit $= 60 + 1.5(60-35) = 97.5$, 110 is an outlier

c)



d) $\Sigma y = 461$ $\Sigma y^2 = 24219$ $S_{yy} = 24219 - 461^2 \div 10 = 2966.$

e) $PMCC = \dfrac{-18.3}{\sqrt{3463.6 \times 2966.9}} = -0.0057$

f) Very little evidence to suggest any relationship exists.

5)

hours	freq (Area)	=	CW (width)	→ ÷	fd (height)
8-10	18		3 = 1.5cm		6 = 3cm
16-25	15		10		1.5 =

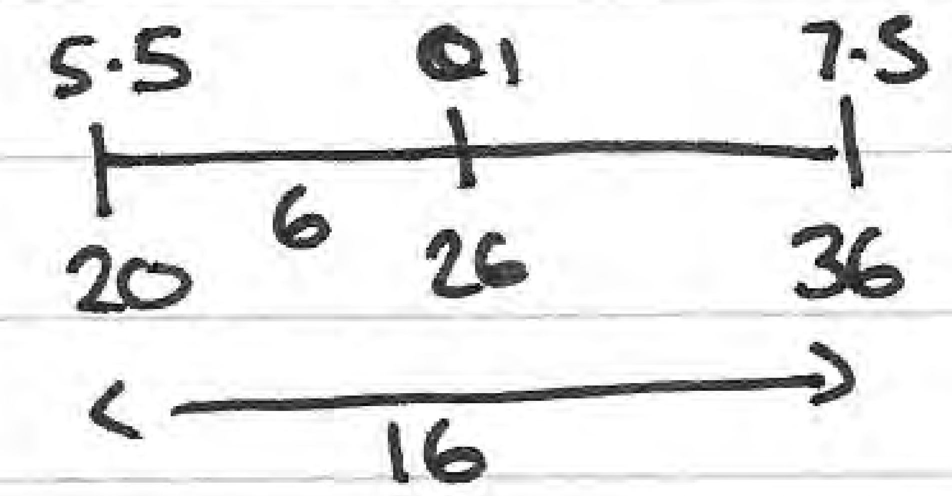
$3 = 1.5cm \Rightarrow 10 = 5cm$ $\quad$ width = 5cm
$\div 2$

$6 = 3cm \Rightarrow 1.5 = 0.75cm$ $\quad$ height = 0.75cm
$\div 2$

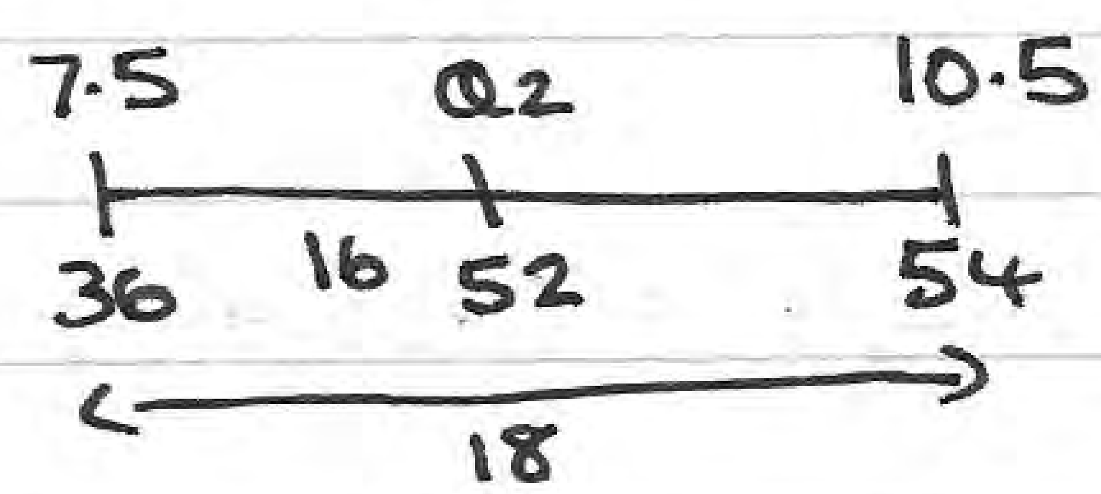
b

hours	freq	CF
0 - 5.5	20	20
5.5 - 7.5	16	36
7.5 - 10.5	18	54
10.5 - 15.5	25	79
15.5 - 25.5	15	94
25.5 - 50.5	10	104

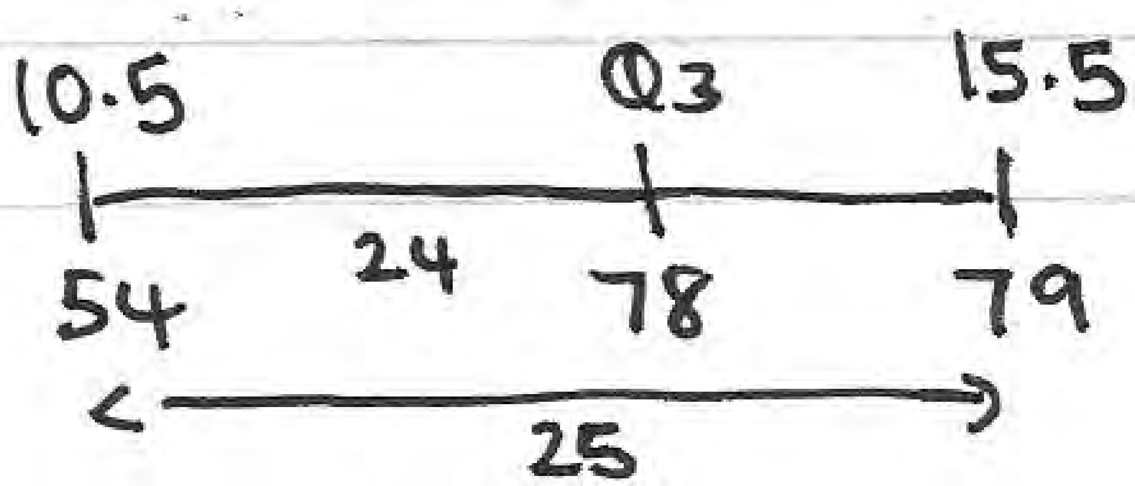
→ $\frac{1}{4}n = 26^{th}$
→ $\frac{1}{2}n = 52^{nd}$
→ $\frac{3}{4}n = 78^{th}$



$\dfrac{Q_1 - 5.5}{2} = \dfrac{6}{16}$ $\quad$ + $\quad$ x $\quad$ $Q_1 = 6.25$



$\dfrac{Q_2 - 7.5}{3} = \dfrac{16}{18}$ $\quad$ + $\quad$ x $\quad$ $Q_2 = 10.17$



$\dfrac{Q_3 - 10.5}{5} = \dfrac{24}{25}$ $\quad$ + $\quad$ x $\quad$ $Q_3 = 15.3$

$IQR = 15.3 - 6.25 = \underline{9.05}$

c) $\sum fx = 20 \times 2.75 + 16 \times 6.5 + \ldots = 1333.5$

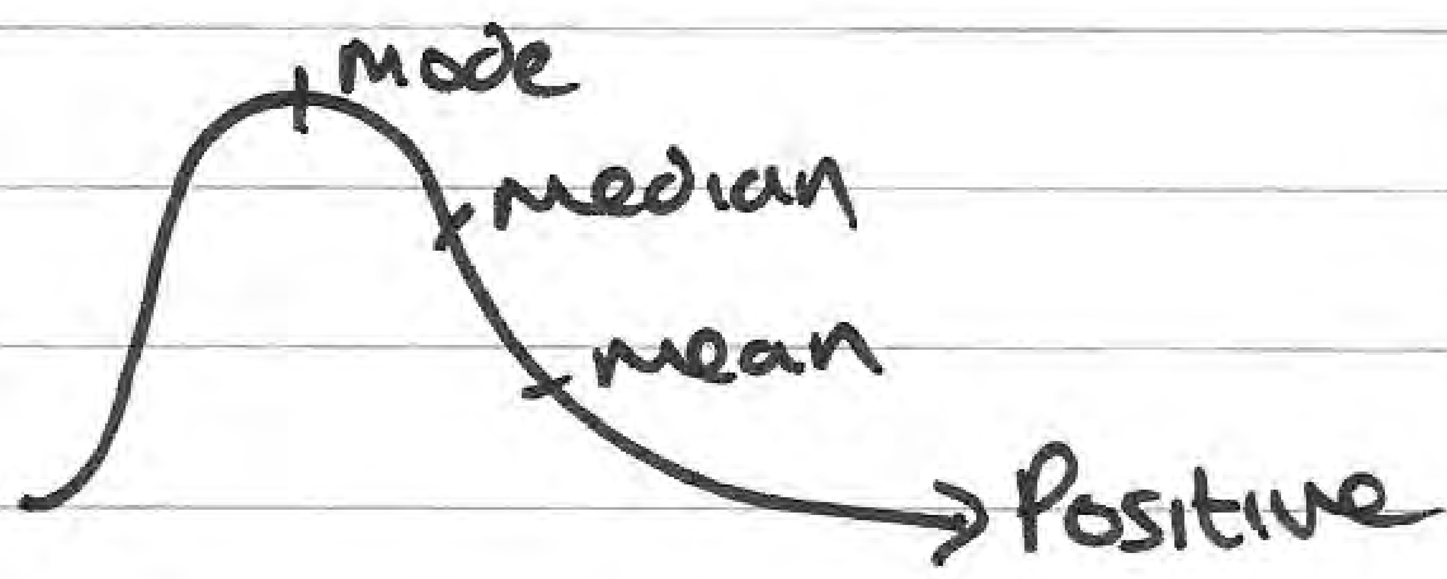
$\sum fx^2 = 20 \times 2.75^2 + 16 \times 6.5^2 + \ldots = 27254$

$\bar{x} = \frac{\sum fx}{n} = \frac{1333.5}{104} = 12.8 \text{ (3sf)}$

$S_{xx} = 27254 - 1333.5^2 \div 104 = 10155.709\ldots$

$Var = \frac{S_{xx}}{n} = 97.65\ldots \Rightarrow \sigma = \sqrt{Var} = \underline{9.88} \text{ (3sf}$

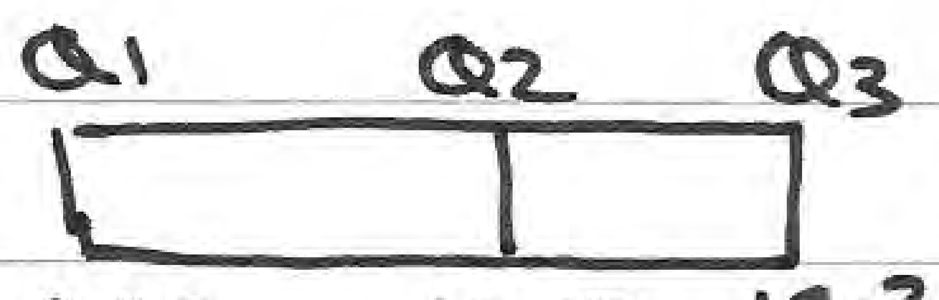
d)



Mean > median
12.8   10.17

$\Rightarrow$ positive skew

or

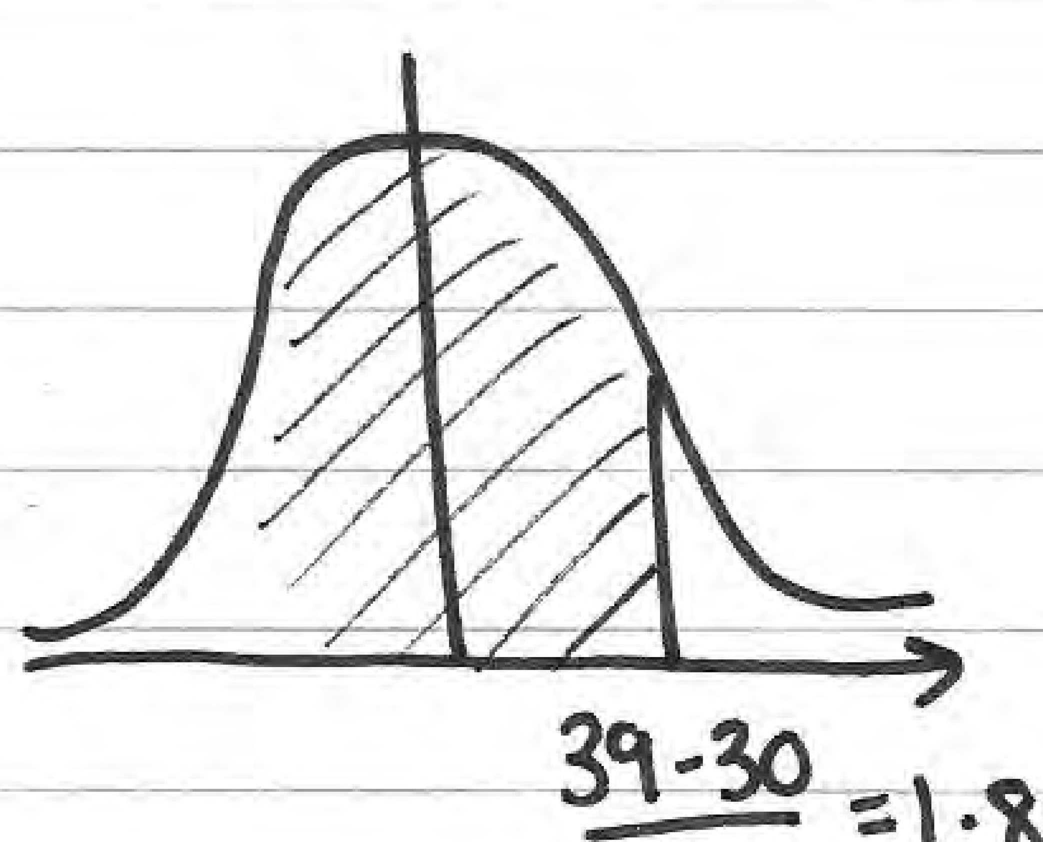


$Q_2 - Q_1 < Q_3 - Q_2$
3.92   5.13

$\Rightarrow$ positive skew

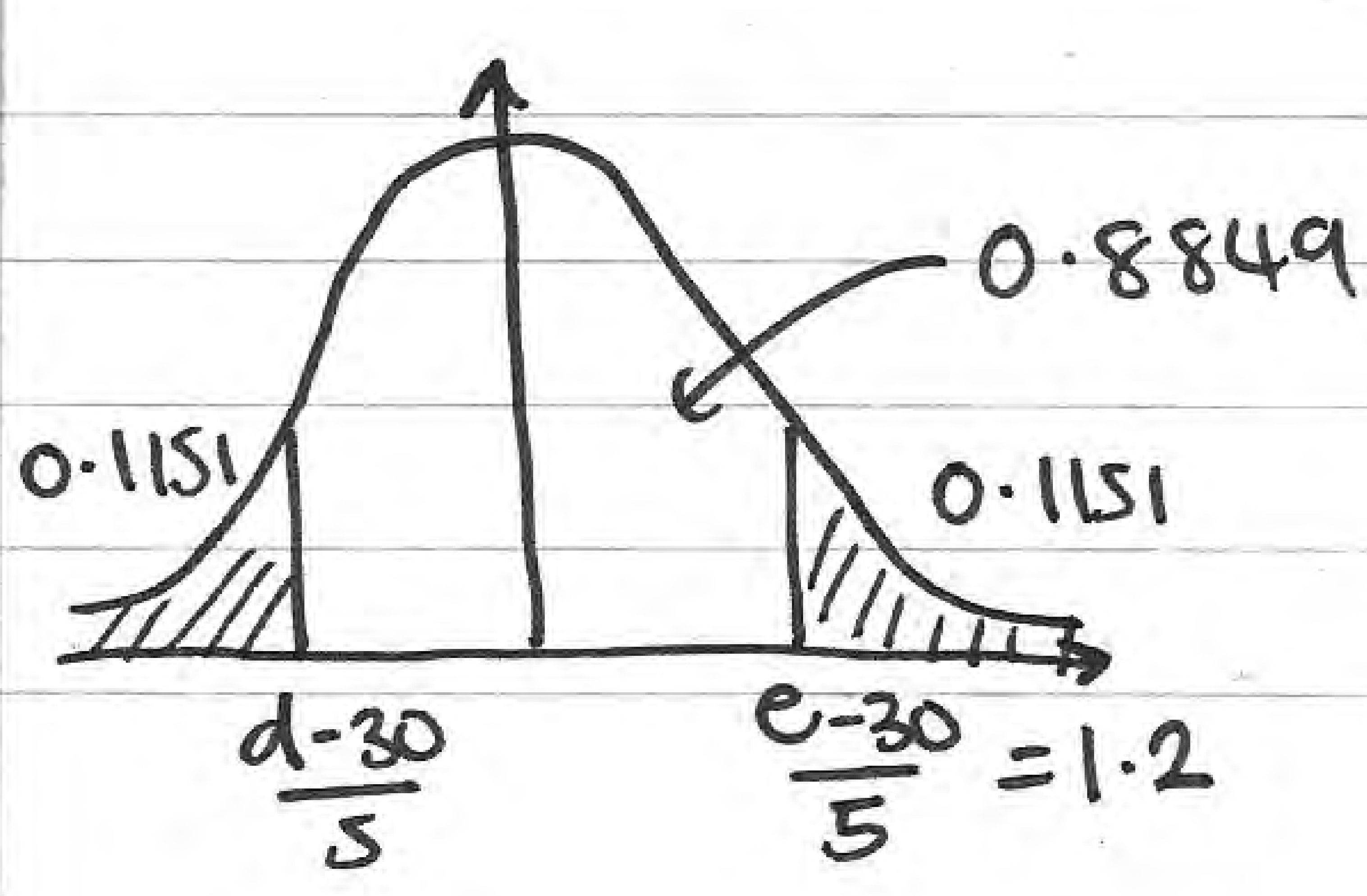
e) data is skewed $\Rightarrow$ recommend median/IQR

6)



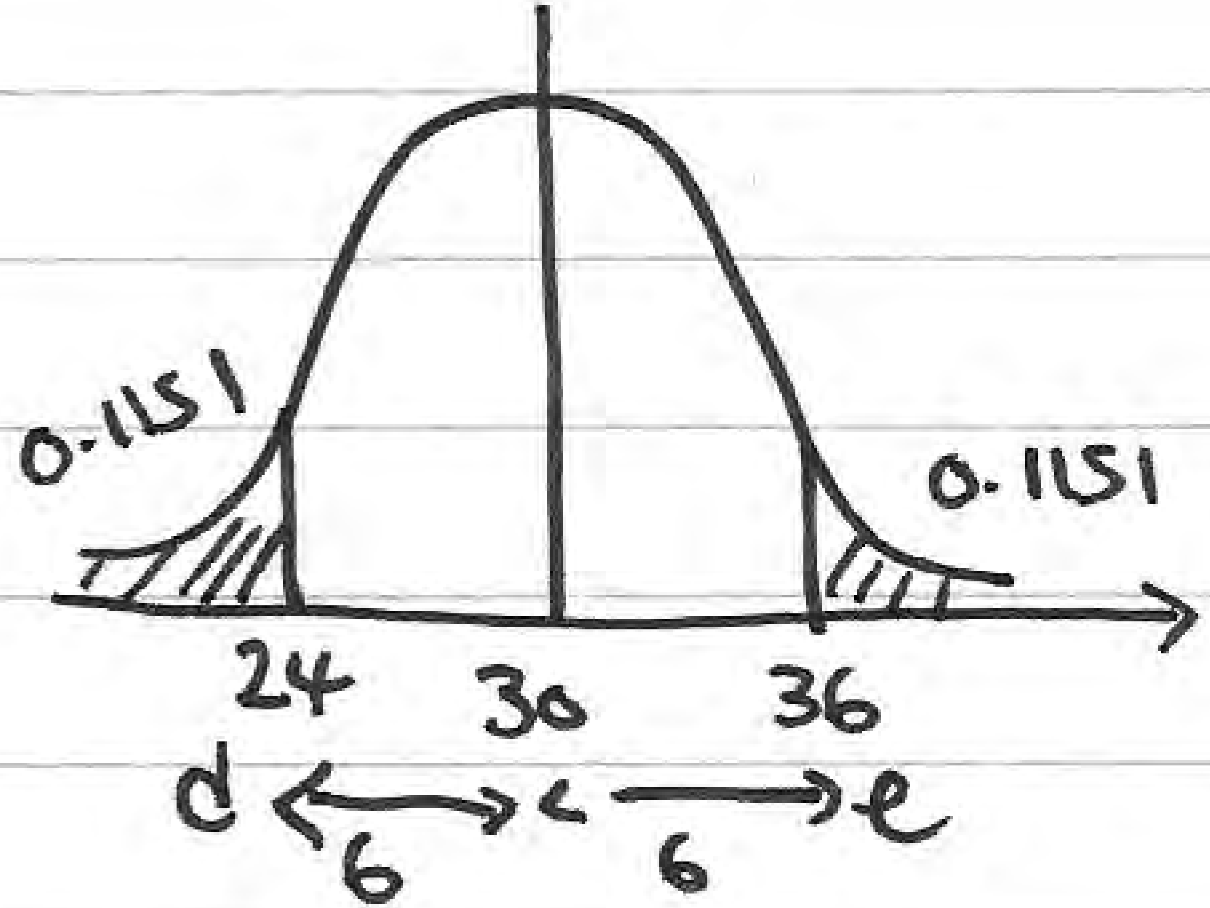
$P(Z < 1.8) = 0.9641$

b)



$P(Z < \frac{e-30}{5}) = 0.8849$

$\frac{e-30}{5} = 1.2 \Rightarrow e - 30 = 6 \Rightarrow e =$



$d = 24,\ e = 36$

$P(d < x < e) = 1 - 0.1151 - 0.1151$

$= \underline{0.7698}$