NO: DATE:

EXERCISE SHEET 19: STATISTICS

① a) T = 0×6 + 1×13 + 2×12 + 3×9 + 4×5 + 5×2 + 6×0 + 7×1
= 84 48

b) mean = 84/48 = 1.75

① a) T = 6 + 13 + 12 + 9 + 3 + 2 + 0 + 1
= 48

b) (0×6) + (1×13) + (2×12) + (3×9) + (9×5) + (5×2) + (6×0) + (7×1) ÷ 48 = 2.1041
Mean ≈ 2.10

c) Mode = 1

d) Median = 2 $\frac{48}{2} = 24$
24th number = 2 $\frac{2+2}{2} = 2$
25th number = 2

② a) i) Mean = 6345 ÷ 8
= 793.125
≈ 793.13 km

ii) Variance = $\frac{1}{n(n-1)}\left[n\sum_{i=1}^{n} - \left(\sum_{i=1}^{n} x_i\right)^2\right]$
= $\frac{1}{8(8-1)}\left[8 \times 11227659 - (6345)^2\right]$
= 885040.125
≈ 885040.13 km²

x	x^2
112	12544
567	321489
2746	7540516
1618	2617924
155	24025
54	2916
311	96721
782	611524
6345	11227659

iii) Standard deviation = $\sqrt{\text{variance}}$
= $\sqrt{885040.125}$
= 940.7657
≈ 940.77 km

③ a) Mean = 1653 ÷ 12
= 137.75

b) Standard deviation = 25.7580
≈ 25.76 cm

c) variance = 663.4772127
≈ 663.48 cm²

d) (132 + 133) ÷ 2 = 132.5

④ f) Mean = 1072 ÷ 12
= 89.3333
≈ 89.33

b) Standard deviation = 7.9353
≈ 7.94

c) Variance = 62.9696
≈ 62.97

d) Range = 105 - 79
= 26

e) Median = (89 + 88) ÷ 2
= 88.5

f) Lower quartile = (82 + 86) ÷ 2
= 84

Upper = (91 + 96) ÷ 2
= 93.5

⑤ a) Mean = 844 ÷ 14
= 60.2857
≈ 60.29

b) Standard deviation = 4.9213
≈ 4.92

c) Variance = 24.247
≈ 24.22

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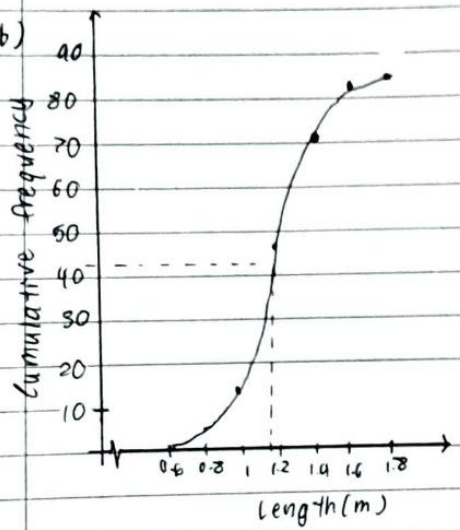
⑥ a)

length (m)	Cumulative frequency
< 0.6	0
< 0.8	3
< 1	13
< 1.2	48
< 1.4	~~48~~ 71
< 1.6	83
≤ 1.8	85

b)



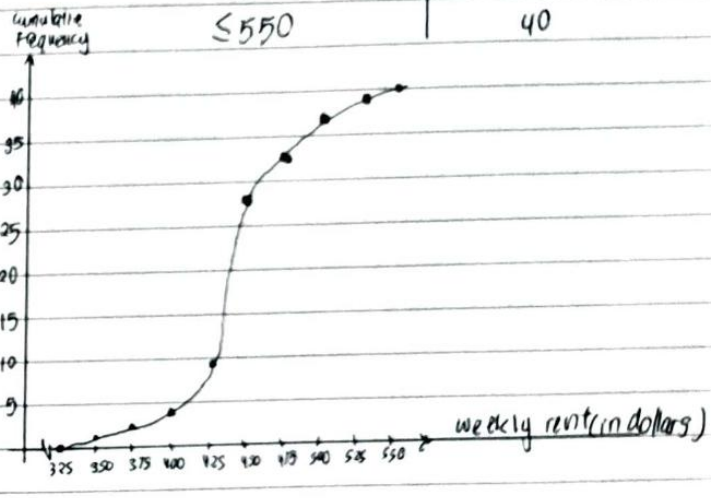
c) Approximately 1.17 metres

⑦ a)

Weekly Rent (in dollars)	Frequency
325 -	1
350 -	1
375 -	2
400 -	5
425 -	19
450 -	5
475 -	4
500 -	2
525 - 550	1
Total	40

b)

Weekly Rent (in dollars)	Cumulative frequency
< 325	0
< 350	1
< 375	2
< 400	4
< 425	9
< 450	28
< 475	33
< 500	37
< 525	39
≤ 550	40



c) i) $\frac{28}{40} \times 100\% = $ ~~40~~ 70%

ii) $\frac{28}{40} \times 100\% = 70\%$

⑧ a) $f'(x) = 6x - \frac{2}{5x^2}$

b) $f'(x) = 3 + 2e^x$

c) $f'(x) = e^x(\ln x + \frac{1}{x})$

d) $f'(x) = 2x\tan x + x^2\sec^2 x$

e) $f'(x) = e^x(\ln x + \frac{1}{x})$

f) $f'(x) = xe^{3x}(2 + 3x)$

g) $f'(x) = \sqrt{1+3x} + \frac{1}{x} \times \frac{1}{2}(1+3x)^{-\frac{1}{2}} \times 3$

$= \sqrt{1+3x} + \frac{3x}{2\sqrt{1+3x}}$

h) $f'(x) = \frac{\ln x - x(\frac{1}{x})}{(\ln x)^2}$

$= \frac{\ln x - 1}{(\ln x)^2}$

i) $f'(x) = \frac{-\sin x(e^{2x}) - e^{2x}\cos x}{e^{2x}}$

$= -\frac{\sin x - \cos x}{e^{2x}}$

j) $f'(x) = \frac{\cos x(x+1) - \sin x}{(x+1)^2}$

k) $f'(x) = \frac{e^{x-1}(x-1)^2}{(x+1)^2}$

l) $f'(x) = \frac{2(2x+1) - 2(x^2+1)}{(2x+1)^2}$

$= \frac{2x^2+2x+2}{(2x+1)^2}$

m) $f'(x) = 7(1-2x^2)^6(-4x)$

$= -28x(1-2x^2)^6$

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n) $f'(x) = \frac{1}{2}(8x+x^4)^{-\frac{1}{2}}(8+4x^3)$

$= \frac{4+2x^3}{\sqrt{8x+x^4}}$

o) $f'(x) = \frac{20x^4+3x^2}{(8x+1)^{\frac{1}{2}}}$

p) $f'(x) = (3+2e^x)e^{3x+2e^x}$

q) $f'(x) = e^{-x^2+1} - xe^{-x^2+1}(-2x)$

$= e^{-x^2+1}(1-2x^2)$

r) $f'(x) = \frac{1}{\sqrt{2x^2+11x}}(24x+11)$

s) $f'(x) = \frac{1}{2}\ln(x^2-1)$

$= \frac{1}{2} \times \frac{1}{x^2-1} \times 2x$

$= \frac{x}{x^2-1}$

t) $f'(x) = \sec^2 x\, e^{\tan x}$

u) $f'(x) = \frac{1}{\sin x}(\cos x)$

$= \cot x$

v) $f'(x) = -\sin x + x\cos x - \frac{2}{x}$

w) $f'(x) = \cos(e^x+1)(e^2)$

x) $f'(x) = 3\left(\frac{1}{\sqrt{1-(3x)^2}}\right)$

$= \frac{3}{\sqrt{1-9x^2}}$

y) $f'(x) = 2x\cos^{-1}x - \frac{x^2}{\sqrt{1-x^2}}$

z) $f'(x) = \frac{2x}{1+x^4}$

aa) $y = xe^y = x+1$

$\frac{d}{dx}\left[(1)\frac{dy}{dx} + 1 \cdot e^y + xe^y\left(\frac{dy}{dx}\right)\right] = \frac{d}{dx}(x+1)$

$\frac{dy}{dx} + e^y + xe^y\left(\frac{dy}{dx}\right) = 1$

$\frac{dy}{dx}(1+xe^y) = 1-e^y$

$\frac{dy}{dx} = \frac{1-e^y}{1+xe^y}$

b) $xy^3 - y^2 = x^2$

$\frac{d}{dx}\left[y^3 + x\,3y^2\left(\frac{dy}{dx}\right) - 2y\left(\frac{dy}{dx}\right)\right] = \frac{d}{dx}(x^2)$

$y^3 + x\,3y^2\frac{dy}{dx} - 2y\frac{dy}{dx} = 2x$

$\frac{dy}{dx}(3xy^2 - 2y) = 2x - y^3$

$\frac{dy}{dx} = \frac{2x-y^3}{3xy^2-2y}$

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