Question 1   Candidate 1

Jill borrows £5650 from a bank.

The annual effective rate of interest on the loan is 9%.

Jill makes level monthly repayments of £186.01 at the end of each month.

Complete the following loan schedule for Jill's loan to show the loan outstanding at the end of month 2.

Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
0	■	■	■	5650
1	186.01	~~42.32~~	~~223.34~~	~~5407.07~~
2	186.01	40.66	226.67	5194.94

5421.6

Question 1   Candidate 2

Jill borrows £5650 from a bank.

The annual effective rate of interest on the loan is 9%.

Jill makes level monthly repayments of £186.01 at the end of each month.

Complete the following loan schedule for Jill's loan to show the loan outstanding at
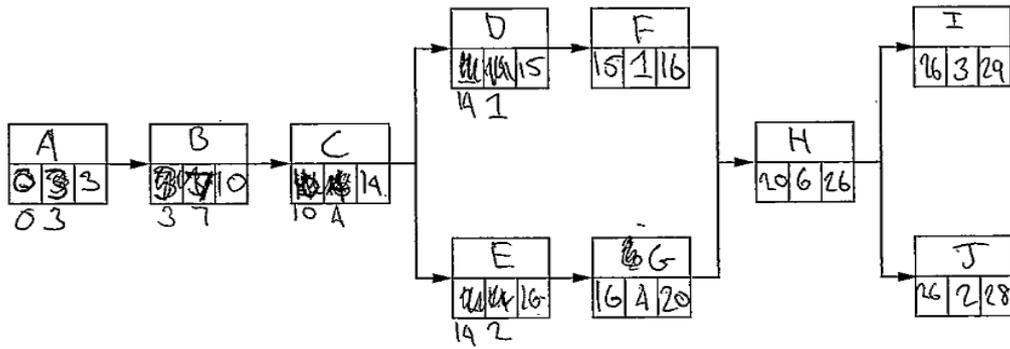the end of month 2.   3

Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
0				5650
1	186.01	42.375	143.635	5506.865
2	186.01	41.2977375	144.7122625	5361.65

Question 2   Candidate 3

(a) Complete the PERT chart showing the earliest start time and the latest completion time for each task.

(An additional diagram, if required, can be found on *page 16*.)

Question 2(b)   Candidate 4

2. (continued)

(b) The roofing company works for 9 hours each day on this job.

State the minimum number of days that the company will require to complete this job.   1
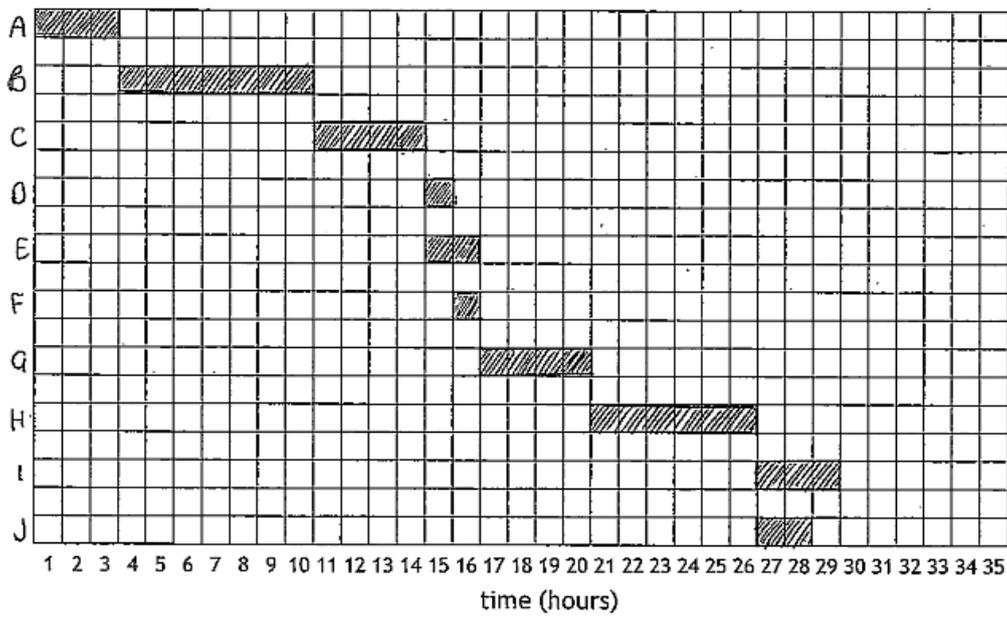
4 days (36 hours total) → only 29 needed.

Question 2(c)   Candidate 5

(c) Construct a Gantt chart, without float times, for this job.   **3**

(An additional grid, if required, can be found on *page 16*.)

time (hours)

Question 2(c)   Candidate 6

(c) Construct a Gantt chart, without float times, for this job.   **3**
    (An additional grid, if required, can be found on *page 16*.)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
time (hours)

Question 2(c)   Candidate 7

(c) Construct a Gantt chart, without float times, for this job.   **3**
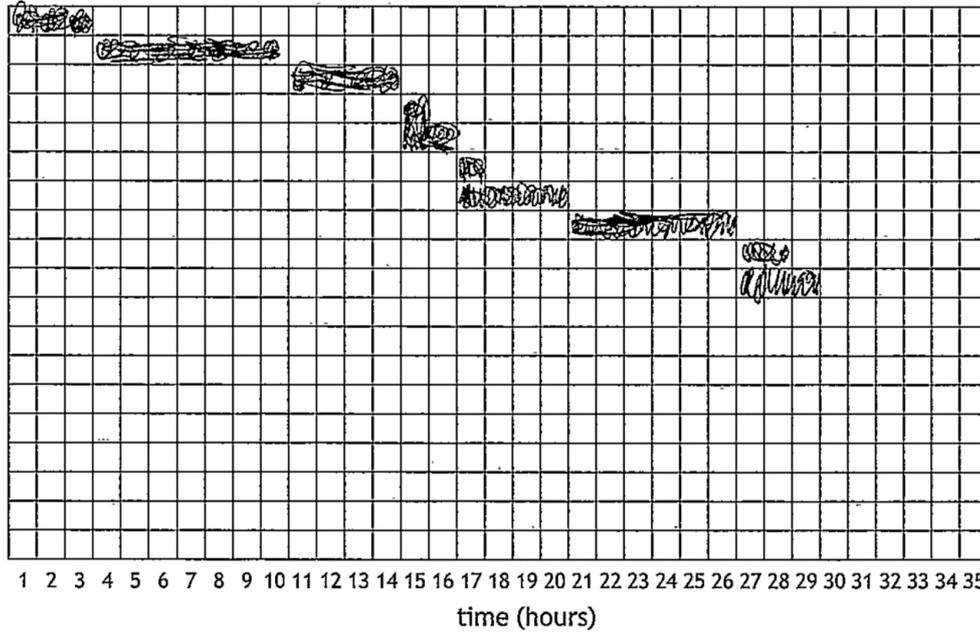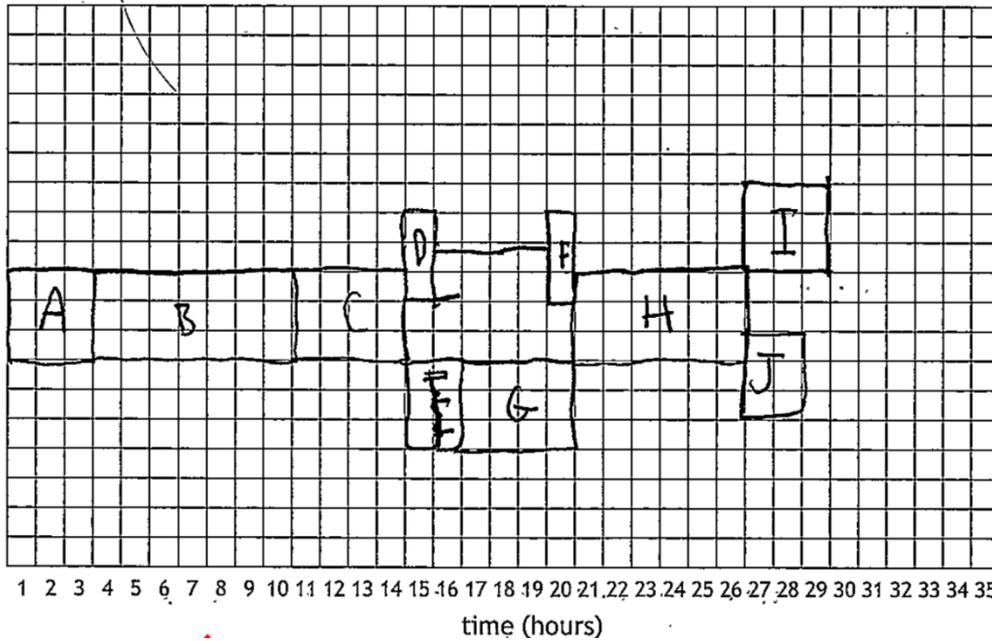   (An additional grid, if required, can be found on *page 16*.)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
time (hours)

Question 3(a)   Candidate 8

(a) State the type of data that best describes the number of dogs requiring treatment for a flea infestation.   1

Numerical Continous

Question 3(b)   Candidate 9

The student vet claims this graph proves that flea infestations are more common in the warmer months across the UK.

(b) Explain why this claim is not valid.   **1**

This Claim is not Valid as the infestations depend on whether the area is rural or Urban.

Question 3(c)   Candidate 10

The data gathered from Study 2 is shown in the table.

Area	Number of dogs inspected	Number of dogs with a flea infestation
Urban Clinic	213	30
Rural Clinic	156	43

(c) State a statistical test that would be appropriate to determine whether this data provides evidence of a difference in flea infestations between urban and rural areas.   **1**

An appropriate test is a two sample t-test.

Question 3(d)   Candidate 11

(d) State one part of the design of Study 2 that would be needed to ensure that the assumptions required to perform the test in (c) are valid.　　**1**

> The "Number of dogs with a flea infestation".

Question 3(e)   Candidate 12

To fit in with the student vet's placements, the data from the urban clinic was collected from July to September, and the data from the rural clinic was collected from October to December.

(e) Explain how this may affect the conclusions of Study 2.   1

This may affect the conclusions as ~~the~~ July to September are warmer months where Fleas are more common meaning the results Will not be ~~too~~ accurate or fair as fleas are less common in October to December.

Question 4(a)   Candidate 13

Zac deposits £500 into a bank account on 1 January 2018, 1 January 2019, and 1 January 2020.

The bank pays interest into his account at the end of every year, using the following annual effective rates:

- 2018   3.3%
- 2019   2.4%
- 2020   1.0%

He makes no withdrawals from his account.

(a) Calculate the balance in Zac's account at the end of 2020.

500 — 1 Jan '18   500 — 1 Jan '19   500 — 1 Jan '20 — Dec 20

3·3%   2·4%   1%

$500 \times 1·033 \times 1·024 \times 1·01 = £534·18$ ⎫ TOTAL
$500 \times 1·024 \times 1·01 = £517·12$ ⎬ $= £1556·30$
$500 \times 1·01 = £505$ ⎭
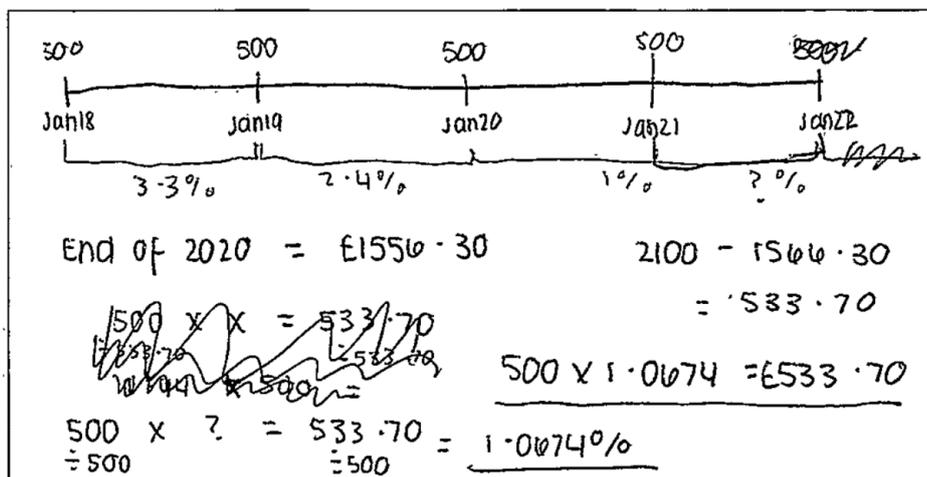
Question 4(b)   Candidate 14

On 1 January 2021 Zac deposits another £500 into his account.

He makes no further deposits into his account in 2021.

(b) Calculate the annual effective rate of interest needed in 2021 for the account
balance to be £2100 by the end of the year.   2

£1556.30 (+500) = £2056.30

£2056.30 ← 96 × 1.0212

= £2099.89

= £2100

(~~2.12%~~
2.12%)

Question 4b   Candidate 15

On 1 January 2021 Zac deposits another £500 into his account.

He makes no further deposits into his account in 2021.

(b) Calculate the annual effective rate of interest needed in 2021 for the account balance to be £2100 by the end of the year.

500   500   500   500   500✓
├─────────────────┼──────────────┼──────────────┼──────────────┤
Jan18   Jan19   Jan20   Jan21   Jan22

3·3%   2·4%   1%   ?%

End of 2020 = £1556·30   2100 - 1566·30

                                        = 533·70

500 × X = 533·70

500 × ? = 533·70 = 500 × 1·0674 = £533·70
÷ 500   ÷ 500 = 1·0674%

Question 4(b)   Candidate 16

(b) Calculate the annual effective rate of interest needed in 2021 for the account balance to be £2100 by the end of the year.

$$1556.31 + 500 = 2056.31$$

$$2100 \div 2056.31 = 1.02146796$$

$$2056.31 \times 1.02146796 = 2100$$

Question 5(a)   Candidate 17

	A	B	C	D	E	F	G	H
1		Name:						
2		SCN:						
3		Centre name:						
4								
5		School Roll Prediction						
6								
7		Number of pupils in August 2021		650				
8		Leavers (%)		18%				
9		School roll at end of year (%)		82%				
10		S1 intake (August)		140				
11		School roll in August 2031		760				
12								
13		Date	Number of Pupils					
14		August 2021	650					
15		August 2022	673.00					
16		August 2023	691.86					
17		August 2024	707.33					
18		August 2025	720.01					
19		August 2026	730.41					
20		August 2027	738.93					
21		August 2028	745.92					
22		August 2029	751.66					
23		August 2030	756.36					
24		August 2031	760.21					
25		August 2032	763.38					
26		August 2033	765.97					
27		August 2034	768.09					
28		August 2035	769.84					
29								

Number of Pupils

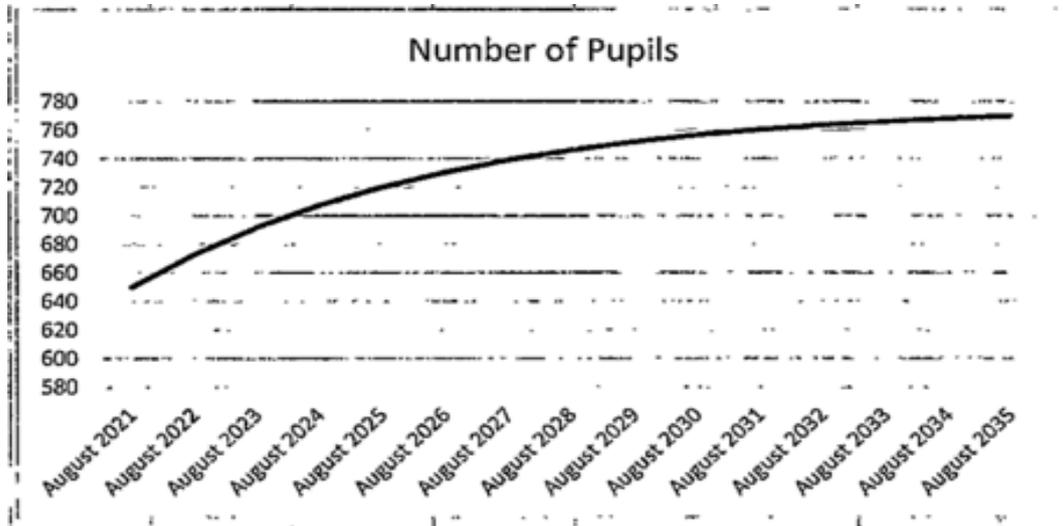## Question 5(b)   Candidate 18

(b) Comment on the relationship between time and the predicted school roll up to August 2031.   1

Number of pupils is constantly increasing

Question 5(c)(i)   Candidate 19

Number of Pupils

Question 5(c)(ii)   Candidate 20

No graph constructed for 5c(i)

(ii) Use your graph to determine whether the new capacity is suitable.   1

The new capacity is suitable as the increase in pupils is predicted to slow down

Question 6(a)   Candidate 21

6. The average price of petrol increased at the following annual effective rates:

   - March 2018 to 2019:   2.1%
   - March 2019 to 2020:   0.5%
   - March 2020 to 2021:   2.0%

   (a) Calculate the overall percentage increase in the average price of petrol over the three years from March 2018 to March 2021.

   $$2.1 + 0.5 + 2.0\% = 4.6\%$$

Question 6(b)   Candidate 22

(b) Hence calculate the average cost of filling a 45-litre tank with petrol in March 2018.

Want of 4·6%

$136.4 \times 95.4\% = 130.1256$

$130.1256 \times 45 = 5855.652$

$= £5855.65$

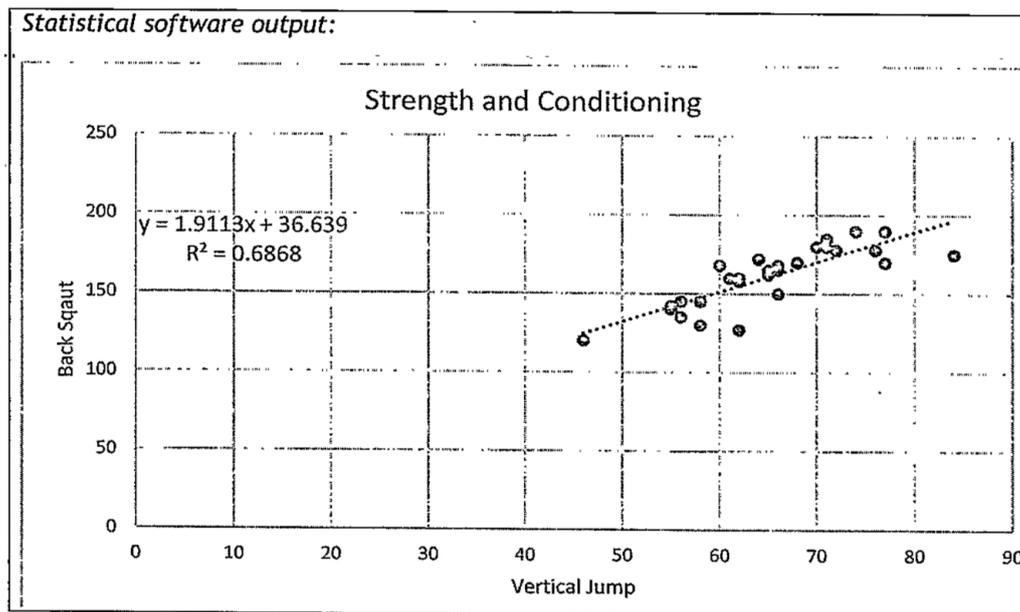## Question 6(b)   Candidate 23

The average price of petrol in March 2021 was 136.4 pence per litre.

(b) Hence calculate the average cost of filling a 45-litre tank with petrol in March 2018.

$136.4 \div 1.047$

$= 135.353 \times 45$

$= £6090.89p$ (2d.p)

Question 7(a)(i)   Candidate 24

Statistical software output:

Strength and Conditioning

$y = 1.9113x + 36.639$
$R^2 = 0.6868$

Back Sqaut (vertical axis: 0, 50, 100, 150, 200, 250)

Vertical Jump (horizontal axis: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90)

Question 7(b)(i)   Candidate 25

Statistical software output:

```
Statistical software output:
 cor.test(jump,back)
       Pearson's product-moment correlation

data:  jump and back
t = 7.6944, df = 27, p-value = 2.825e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6638573 0.9167773
sample estimates:
       cor
0.8287274
```

Answer:

Question 7(d)   Candidate 26

Answer: Those with a higher squat weight will already be physically fit, meaning their jump height will be higher due to their fitness. Increasing back squat weight will not automatically make someone jump higher.

Question 8(a)   Candidate 27

(a) Calculate how much income tax Sophie expects to pay each year.

Annual Gross Pay = £1000 × 12
                 = £12000
Commission = £20 × 150
Per Year   = £3000
            = £3000 × 12
            = £36000
Gross Pay + = £12000 + £36000
Commission = £48000
   P.m   = £48000 ÷ 12
            = £4000

Pension = 2.5% of £4000   Gross Pay = £4000 − £100.
        = 0.025 × £4000   − Pension = £3900
        = £100.
Company = 6.5% of £4000   New Gross = £3900 + £260
Contribution = 0.065 × £4000   Pay   = £4160
            = £260
New Gross = £4160 × 12
Pay p.a = £49920

Annual Income = 19% of (£14667 − £12570)
  Tax   = 0.19 × £2097
            = £398.43

Continued at the back.

ADDITIONAL SPACE FOR ANSWERS

Basic Rate = 20% of (£25296 − £14667)
= 0.22 × £10629
= £2125.80

Intermediate = 21% of (£43662 − £25296)
Rate   = 0.21 × £18366
= £3856.86

Higher Rate = 41% of (49920 − 43662)
= 0.41 × £6258
= £2565.78

Total Annual = £398.43 + £2125.80 + £3856.86 + £2565.78
Income Tax = £8946.87

Question 8(b)   Candidate 28

Sophie's pension fund earns an annual effective rate of interest of 10%.

(b) Calculate the expected value of Sophie's pension fund immediately after the third pension contribution is made.

Monthly Interest Rate $= (1+10)^{\frac{1}{12}} - 1$

$= 0.22\%$

$£100 \times 1.22 = £122$

$£122 \times 3 = £366$

Pension Fund After 3rd Contribution $= £366$

Question 9(a)   Candidate 29

		Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
4						
5	Loan Repayment Schedule					
6						
7	Initial loan amount	£ 15,000.00				
8	Annual effective interest rate	9.50%				
9	Monthly effective interest rate	0.76%				
10	Loan Period (months)	48				
11	Monthly Repayment	£ 374.06				
12	Final Repayment					
13						
14						
15		0				15,000.00
16		1	374.06	113.87	260.19	14,739.81
17		2	374.06	111.90	262.16	14,477.65
18		3	374.06	109.91	264.15	14,213.50
19		4	374.06	107.90	266.16	13,947.34
20		5	374.06	105.88	268.18	13,679.17
21		6	374.06	103.85	270.21	13,408.96
22		7	374.06	101.79	272.27	13,136.69
23		8	374.06	99.73	274.33	12,862.36
24		9	374.06	97.65	276.41	12,585.95
25		10	374.06	95.55	278.51	12,307.44
26		11	374.06	93.43	280.63	12,026.81
27		12	374.06	91.30	282.76	11,744.05
28		13	374.06	89.16	284.90	11,459.15
29		14	374.06	86.99	287.07	11,172.08
30		15	374.06	84.81	289.25	10,882.84
31		16	374.06	82.62	291.44	10,591.40
32		17	374.06	80.40	293.66	10,297.74
33		18	374.06	78.18	295.88	10,001.86
34		19	374.06	75.93	298.13	9,703.73
35		20	374.06	73.67	300.39	9,403.34
36		21	374.06	71.39	302.67	9,100.67
37		22	374.06	69.09	304.97	8,795.70
38		23	374.06	66.77	307.29	8,488.41
39		24	374.06	64.44	309.62	8,178.80
40		25	374.06	62.09	311.97	7,866.83
41		26	374.06	59.72	314.34	7,552.49
42		27	374.06	57.33	316.73	7,235.76
43		28	374.06	54.93	319.13	6,916.63
44		29	374.06	52.51	321.55	6,595.08
45		30	374.06	50.07	323.99	6,271.09
46		31	374.06	47.61	326.45	5,944.64
47		32	374.06	45.13	328.93	5,615.71
48		33	374.06	42.63	331.43	5,284.28
49		34	374.06	40.12	333.94	4,950.35
50		35	374.06	37.58	336.48	4,613.87
51		36	374.06	35.03	339.03	4,274.84

	A	B	C	D	E	F
1		Name:				
2		SCN:				
3		Centre name:				
4						
52		37	374.06	32.45	341.61	3,933.23
53		38	374.06	29.86	344.20	3,589.03
54		39	374.06	27.25	346.81	3,242.22
55		40	374.06	24.61	349.45	2,892.77
56		41	374.06	21.96	352.10	2,540.67
57		42	374.06	19.29	354.77	2,185.90
58		43	374.06	16.59	357.47	1,828.43
59		44	374.06	13.88	360.18	1,468.26
60		45	374.06	11.15	362.91	1,105.35
61		46	374.06	8.39	365.67	739.68
62		47	374.06	5.62	368.44	371.24
63		48	374.06	2.82	371.24	0.00

Question 9(b)   Candidate 30

7	Initial loan amount	£ 15,000.00			
8	Annual effective interest rate	11.05%			
9	Monthly effective interest rate	0.88%			
10	Loan Period (months)	48			
11	Monthly Repayment	£ 300.00			
12	Additional Payment	£ 5,000.00			
13					

	Time (months)	Repayment (£)	Interest content of repayment (£)	Capital content of repayment (£)	Loan outstanding (£)
15	0				15,000.00
16	1	300.00	131.55	168.45	14,831.55
17	2	300.00	130.07	169.93	14,661.62
18	3	300.00	128.58	171.42	14,490.20
19	4	300.00	127.08	172.92	14,317.28
20	5	300.00	125.56	174.44	14,142.84
21	6	300.00	124.03	175.97	13,966.87
22	7	300.00	122.49	177.51	13,789.36
23	8	300.00	120.93	179.07	13,610.29
24	9	300.00	119.36	180.64	13,429.65
25	10	300.00	117.78	182.22	13,247.43
26	11	300.00	116.18	183.82	13,063.61

52	37	300.00	69.33	230.67	7,674.86
53	38	300.00	67.31	232.69	7,442.17
54	39	300.00	65.27	234.73	7,207.44
55	40	300.00	63.21	236.79	6,970.65
56	41	300.00	61.13	238.87	6,731.78
57	42	300.00	59.04	240.96	6,490.82
58	43	300.00	56.92	243.08	6,247.74
59	44	300.00	54.79	245.21	6,002.53
60	45	300.00	52.64	247.36	5,755.17
61	46	300.00	50.47	249.53	5,505.64
62	47	300.00	48.28	251.72	5,253.92
63	48	5,300.00	46.08	5,253.92	-

Question 9(c)   Candidate 31

(c) State two reasons why Maria might decide to purchase the car using the bank loan instead of the car dealership finance options.   2

- Significantly lower Interest rate
- Maria may not have the money available to afford the final £5000 payment
- ~~Might not want to keep~~
- Want to keep the car afterwards.
- No additional charges.
- Car is the own.

Question 10(a)   Candidate 32

The 2020 study found that the population of mountain gorillas had increased to 1004.

An expert has stated that if the mountain gorilla population in the Virunga Mountains continues to grow exponentially there will be 1600 gorillas by the year 2032.

(a) Determine if the expert's statement is correct.

Give a reason for your answer.   2

$$1004 - 680$$

$$= \frac{324}{680} \times 100 = 47.65\% \qquad \begin{array}{l} 2032 - 2020 \\ = 12yrs \end{array}$$

$$2020 - 2008 \qquad \frac{47.65}{100} \times 1004 = 478.406$$

$$= 12yrs \qquad \text{- this statement is not}$$

correct as it the amount of mountain

$$1004 + 478.406 = 1482.406$$

Question 10(a)   Candidate 33

The 2020 study found that the population of mountain gorillas had increased to 1004.

An expert has stated that if the mountain gorilla population in the Virunga Mountains continues to grow exponentially there will be 1600 gorillas by the year 2032.

(a) Determine if the expert's statement is correct.

Give a reason for your answer.   2

2008 – 680 Gorillas $\frac{1004 - 680}{2020 - 2008}$

2020 – 1004 Gorillas

= 27 × 12 years

= 324 more Gorillas   1004 + 324 = 1328

The experts statement was false as there is estimated to only be around 1328 which is less than the estimated value of 1600

Question 10(b)   Candidate 34

A typical adult mountain gorilla eats 30 kg of food per day.

(b) Estimate the **maximum** amount of termites and ants (in kg) that a typical mountain gorilla will eat during their adult lifetime.

State any assumptions you have made.   3

life span = 35 years

30 x 35 x 365 = 383,250 kg in a life time.

Question 10(b)   Candidate 35

A typical adult mountain gorilla eats 30 kg of food per day.

(b) Estimate the **maximum** amount of termites and ants (in kg) that a typical mountain gorilla will eat during their adult lifetime.

State any assumptions you have made.   ③

Adult life Time = 20 years.

30 kg daily
30 × 365 = 10950 kg yearly

10950 × 25 = 273750 lifetime.