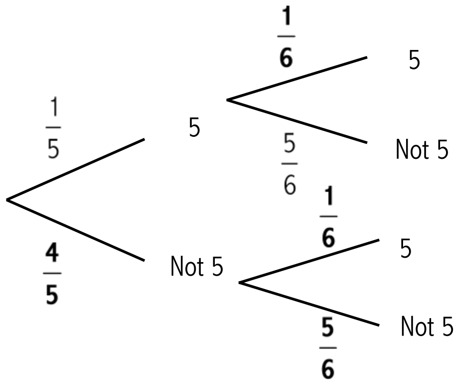
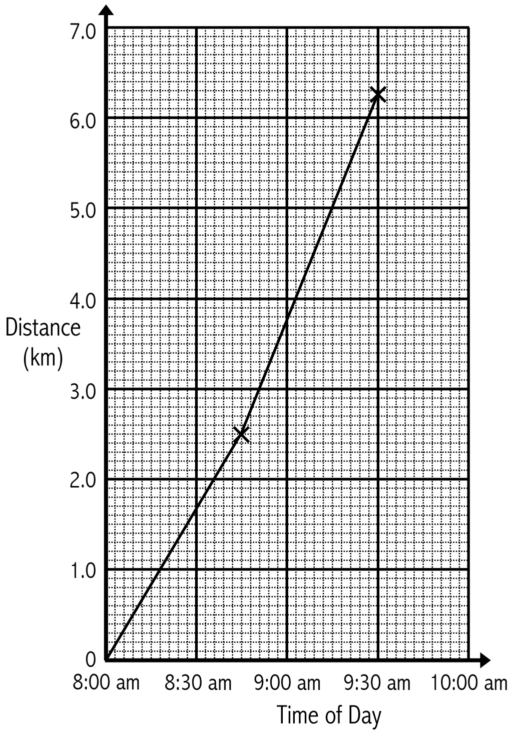
OCR Practice GCSE Examination Paper Higher Set 3 Paper 4 Calculator	Solutions

Qu №	Answer	Solutions	Marks		Spec.
1a		$\text{P(5 on the spinner)} = \frac{1}{5}$ $\text{P(not a 5 on the spinner)} = 1 - \frac{1}{5} = \frac{4}{5}$ $\text{P(5 on the dice)} = \frac{1}{6}$ $\text{P(not a 5 on the dice)} = 1 - \frac{1}{6} = \frac{5}{6}$	A1 at least 2 correct A1 all correct		P4 P6
b		A win is getting a 5 on both the spinner and the dice $\text{P(5 on the spinner)} = \frac{1}{5}$; $\text{P(5 on the dice)} = \frac{1}{6}$ $\text{P(winning)} = \frac{1}{5} \times \frac{1}{6}$	M1		P8
	$\frac{1}{30}$	$= \frac{1}{30}$	A1	**4**	
2a		$\theta = x$; opposite = 8 cm; adjacent = 15 cm $\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$	M1		G20
		$\rightarrow \theta = \tan^{-1}\left(\frac{\text{opposite}}{\text{adjacent}}\right)$ $x = \tan^{-1}\left(\frac{8}{15}\right)$	M1		
	28.1°	= 28.072… = 28.1° correct to 1 decimal place	A1		
b		$\theta = y$; adjacent = 8 cm; hypotenuse = 12 cm $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$	M1		G20
		$\rightarrow \theta = \cos^{-1}\left(\frac{\text{adjacent}}{\text{hypotenuse}}\right)$ $y = \cos^{-1}\left(\frac{8}{12}\right) = \cos^{-1}\left(\frac{2}{3}\right)$	M1		
	48.2°	= 48.1896… = 48.2° correct to 1 decimal place	A1	**6**	

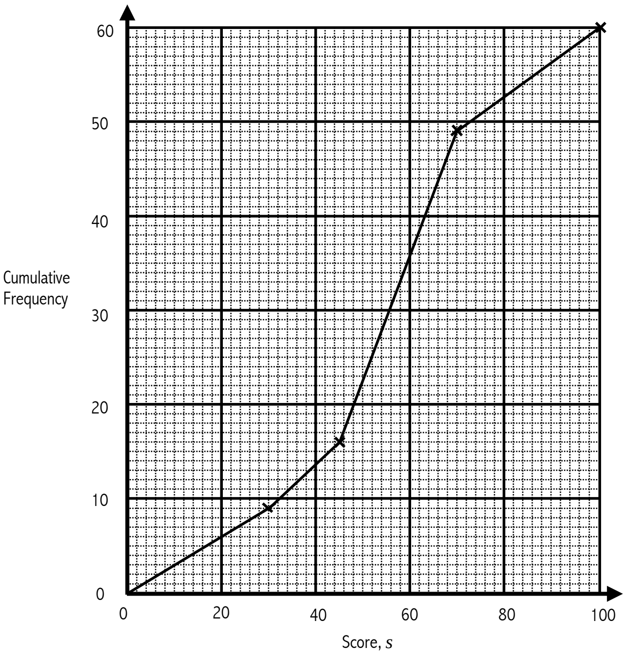
Qu №	Answer	Solutions	Marks		Spec.
3a		Average speed between 8:45 & 9:30 was 5 km/h 8:45 to 9:30 is 45 minutes $= \frac{3}{4}$ hour $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$ $\rightarrow \text{Distance} = \text{Speed} \times \text{Time}$ Distance travelled between 8:45 & 9:30 is $5 \times \frac{3}{4} = 3.75$ km	M1 method to find distance travelled between 8:45 & 9:30		A14
		Total distance travelled to work is 2.5 + 3.75 = 6.25 km	M1 finding total distance travelled between 8:00 & 9:30 A1 graph correct from 8:00 to 8:45 A1 graph correct from 8:45 to 9:30		
b		10:15 to 10:30 is 15 minutes Steven walked 0.6 km in 15 minutes 15 minutes = $\frac{1}{4}$ hour	M1		R11
		$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$ Average walking speed to coffee shop is $0.6 \div \frac{1}{4}$	M1		
	2.4 km/h	= 2.4 km/h	A1	**7**	
4		Volume of cylinder = $\pi r^2 l$ where r is the radius and l is the length Length of the cylinder is 8 cm; volume of the cylinder is 392 $8\pi r^2 = 392$ [÷8] $\pi r^2 = 49$ [$\div\pi$]	M1 $\div 8\pi$		G16
		$r^2 = 15.597...$ [$\sqrt{\ }$]	M1 $\sqrt{\ }$		
	3.9 cm	$r = 3.949\ldots = 3.9$ cm correct to 1 decimal place	A1	**3**	
5		$\theta = 72°$; Opposite = Measured height of building ; Adjacent = 22 m $\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$	M1		G20 N15
		$\rightarrow \text{opposite} = \tan(\theta) \times \text{adjacent}$ Measured height of building = $\tan(72°) \times 22 = 67.7...$ m	M1		
		Device is placed 1.6 m above ground Total height of building is 67.7… + 1.6	M1		
	69 m	= 69.3… = 69 m correct to the nearest metre	A1	**4**	

Qu №	Answer	Solutions	Marks		Spec.
6	**'Prove That' Qu** *working must be shown*	***Working must be shown*** Let $n = 0.\dot{2}\dot{1} = 0.2121212121...$ $100n = 21.21212121...$	M1		N10
		$100n - n = 21.0000000...$ $99n = 21$	M1		
		$n = \frac{21}{99} = \frac{21 \div 3}{99 \div 3} = \frac{7}{33}$ $0.\dot{2}\dot{1} = \frac{7}{33}$	A1	**3**	
7	**'Show That' Qu** *Working must be shown*	3.5 kg = 3.5 × 1000 = 3500 g	M1		N14 G17
		Volume of sphere $= \frac{3500}{7} = 500 \text{ cm}^3$	M1		
		$\therefore \frac{4}{3}\pi r^3 = 500$ $\pi \approx 3 \;\therefore \frac{4}{3}\pi r^3 \approx 4r^3$ $\therefore 4r^3 \approx 500$	M1 approximation of π		
		$r^3 \approx 125$ [cube root]	M1		
		$r \approx 5$ cm	A1		
		Any relevant comment, e.g. 6.5 cm is not accurate even to 1 significant figure, or margin of error is too great to be reliable	A1 oe	**6**	
8		The possible error in x is 0.05 Minimum: 43.7 – 0.05 = 43.65 Maximum: 43.7 + 0.05 = 43.75 The possible error in y is 0.005 Minimum: 9.28 – 0.005 = 9.275 Maximum: 9.28 + 0.005 = 9.285	M1 finding bounds of at least 1 measurement M1 correct bounds for both measurements		N16
		Lower bound for z is the minimum value of x × the minimum value of y = 43.65 × 9.275	M1 method to find lower bound		
	404.85375	= 404.85375	A1	**4**	
9a		$\begin{array}{\|c\|c\|c\|c\|c\|} \hline n & 1 & 2 & 3 & 4 \\ \hline \text{Term} & 5 & 13 & 21 & 29 \\ \hline \end{array}$ + 8 + 8 + 8 The common difference between terms is 8 so find $8n$ values	M1 expression includes $8n$		A24 A25
	$8n - 3$	$\begin{array}{\|c\|c\|c\|c\|c\|} \hline 8n & 8 & 16 & 24 & 32 \\ \hline \text{Term} & 5 & 13 & 21 & 29 \\ \hline \end{array}$ – 3 The difference between $8n$ values & the terms is –3, so the n^{th} term is $8n - 3$	A1 correct expression		
b		Let first term of sequence = n 4 terms: n, n + 8, n +16, n + 24	M1 write out 4 terms algebraically		A21 A23
		Sum of terms = 4 $\therefore n + n + 8 + n + 16 + n + 24 = 4$ [simplify]	M1		
		$4n = -44$ [÷4] $n = -11$	A1		
	–11, –3, 5, 13	Substituting n value into terms: 4 terms are –11, –3, 5, 13	B1	**6**	

Qu №	Answer	Solutions	Marks		Spec.
10a		$x^2 - x = 30$, so $x^2 - x - 30 = 0$ Factorise into form $(x+a)(x+b)$ where $a+b=-1$, $ab=-30$ 5 + (–6) = –1, 5 × (–6) = –30 $(x+5)(x-6)=0$ [divide by either bracketed term]	M1 accept other methods M1 $(x \pm 5)(x \pm 6)$		A4 A18
	$x=-5$ or $x=6$	$x+5=0$ or $x-6=0$ $x=-5$ or $x=6$	A1		
b		$2x^2+20x+54$ [÷ 2] $=2(x^2+10x+27)$ [complete the square]	M1		A4
	$2(x+5)^2+4$	$=2(x^2+10x+25+2)$ [factorise] $=2(x+5)^2+2\times 2$ [simplify]	M1		
	($a=2$, $b=5$, $c=4$)	$=2(x+5)^2+4$ ($a=2$, $b=5$, $c=4$)	A1	**6**	
11		Area of quarter circle $=\frac{1}{4}\times\pi r^2$ [substitute in $r=11$]	M1		R9 G17
		$=\frac{1}{4}\times\pi\times 11^2$ [simplify] $=\frac{121}{4}\pi$ cm²	M1		
		Area of rectangle PQRS = 11 × 20 = 220 cm²	M1		
		Shaded area = area of PQRS – area of quarter circle $= 220 - \frac{121}{4}\pi = 124.966\ldots$ cm²	M1		
		Percentage of PQRS that is shaded $=\frac{124.966\ldots}{220}\times 100$	M1		
	56.8%	= 56.8031… = 56.8% (1 dp)	A1	**6**	
12		Arc length $=42=\frac{100}{360}\times 2\pi r$ [rearrange for r]	M1		G17 G18
		$r=42\div\frac{100}{360}\div 2\pi$ [flip fraction]	M1		
	24.1 cm	$=42\times\frac{360}{100}\div 2\pi=\frac{42\times 360}{200\pi}$ = 24.0642… = 24.1 cm (3 sf)	A1	**3**	

<table>
<tr><th>Qu №</th><th>Answer</th><th>Solutions</th><th colspan="2">Marks</th><th>Spec.</th></tr>
<tr><td>13a</td><td colspan="2">

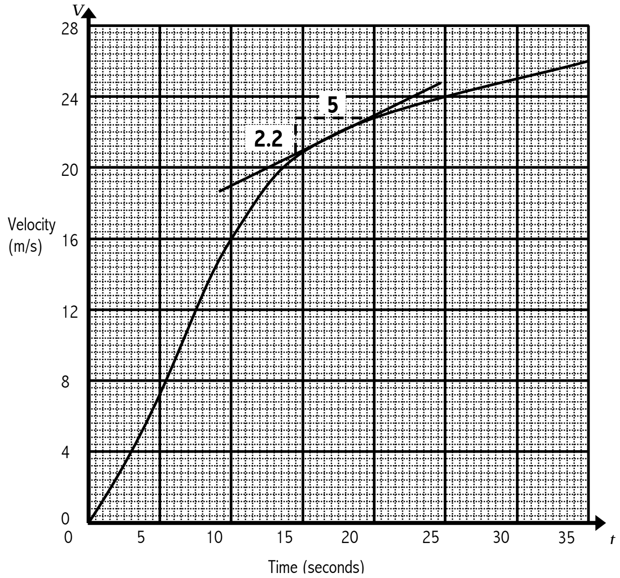
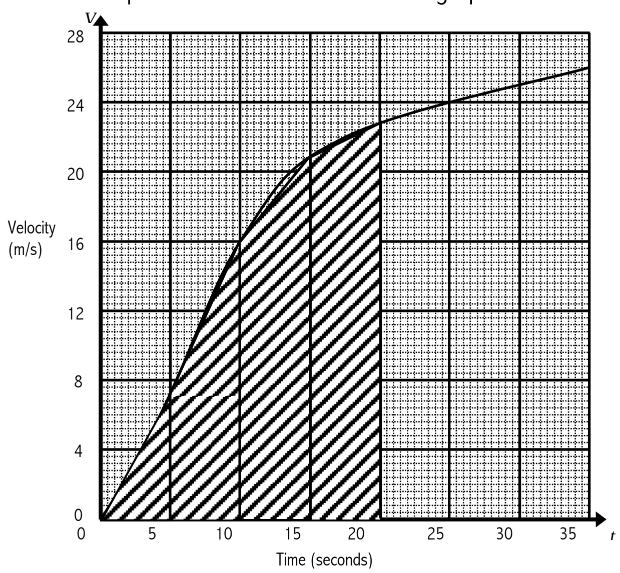
Score, s	$s \leq 30$	$s \leq 45$	$s \leq 70$	$s \leq 100$
Cumulative Frequency	9	9 + 17 = 26	26 + 23 = 49	49 + 11 = 60

</td><td>A1</td><td></td><td>S3</td></tr>
<tr><td>b</td><td colspan="2">
</td><td>A1 all points plotted correctly
A1 curve or straight line segments through plotted points
A1 axis and scale correctly labelled</td><td></td><td>S3</td></tr>
<tr><td>c</td><td>Any suitable explanation</td><td>e.g. Scores between 45 and 70 may not be evenly distributed</td><td>A1</td><td>5</td><td>S4</td></tr>
<tr><td>14</td><td></td><td>Either:
Number of strawberries per punnet
$= \frac{168}{12} = 14$
Or:
Total no. seeds = 3000 × 12
= 36 000</td><td>M1</td><td></td><td rowspan="3">R7</td></tr>
<tr><td></td><td></td><td>Either:
No. seeds per punnet = 3000
$\therefore$ number of seeds per strawberry
$= \frac{3000}{14}$
Or:
Number of strawberries = 168
Number of seeds per strawberry
$= \frac{36\ 000}{168}$</td><td>M1</td><td></td></tr>
<tr><td></td><td>214.3</td><td>Either: = 214.285… = 214.3 (1 dp)
Or: = 214.285… = 214.3 (1 dp)</td><td>A1</td><td>3</td></tr>
<tr><td>15a</td><td></td><td>Total films = 110
Number of animated films not made in the 21st century = x
$110 = 17 + x + (2x-3) + x(x-7)$ [expand brackets]</td><td>M1 set up equations</td><td></td><td rowspan="5">A18
P6
P9</td></tr>
<tr><td></td><td></td><td>$110 = 17 + x + 2x - 3 + x^2 - 7x$ [simplify]
$x^2 - 4x - 96 = 0$ [factorise]</td><td>M1 quadratic expression</td><td></td></tr>
<tr><td></td><td></td><td>$(x-12)(x+8) = 0$</td><td>M1 factorisation</td><td></td></tr>
<tr><td></td><td></td><td>x = 12 or –8
x cannot be negative, $\therefore x = 12$</td><td>M1</td><td></td></tr>
<tr><td></td><td>$\frac{6}{55}$ oe</td><td>P (animated film not made in 21st century) $= \frac{12}{110} = \frac{6}{55}$</td><td>A1</td><td></td></tr>
<tr><td>b</td><td></td><td>Number of animated films made in the 21st century $= 2x - 3$; x = 12
$\therefore 2x - 3 = 2(12) - 3 = 24 - 3 = 21$</td><td>M1</td><td></td><td rowspan="2">P6
P9</td></tr>
<tr><td></td><td>$\frac{21}{110}$</td><td>P (animated film from 21st century)
$= \frac{\text{Number of animated films made in 21}^{\text{st}}\text{ century}}{\text{Total number of films}} = \frac{21}{110}$</td><td>A1</td><td>7</td></tr>
</table>

Qu №	Answer	Solutions	Marks		Spec.
16a		$x_{n+1}=\dfrac{2x_n^3-11}{3x_n^2+7}$ $x_1=\dfrac{2x_0^3-11}{3x_0^2+7}=\dfrac{2\times1^3-11}{3\times1^2+7}=-0.9$	M1 1st iteration		A20 N15
		$x_2=\dfrac{2x_1^3-11}{3x_1^2+7}=\dfrac{2\times(-0.9)^3-11}{3\times(-0.9)^2+7}=-1.32110...$	M1 2nd iteration		
		$x_3=\dfrac{2x_2^3-11}{3x_2^2+7}=\dfrac{2\times(-1.32110...)^3-11}{3\times(-1.32110...)^2+7}=-1.27587...$ $x_4=\dfrac{2x_3^3-11}{3x_3^2+7}=\dfrac{2\times(-1.27587...)^3-11}{3\times(-1.27587...)^2+7}=-1.27519...$ $x_5=\dfrac{2x_4^3-11}{3x_4^2+7}=\dfrac{2\times(-1.27519...)^3-11}{3\times(-1.27519...)^2+7}=-1.27519...$			
	$x=-1.2752$	$x=-1.2752$ to 4 d.p.	A1 cao		
b		$x^3+7x+11$ $=(-1.2752)^3+7(-1.2752)+11$ $=-0.0000474...$	B1		A2 N15
	Any valid comment	**e.g.** gives 0 to 4 d.p. / answer is suitably close to 0	B1	**5**	
17		Frequency = frequency density × class width	M1		S3
		16 people waited 80 – 120 seconds for their call to be answered The class width is 120 – 80 = 40 The frequency density is 16 ÷ 40 = 0.4	M1		
		The *y*-axis scale increases by 0.05 unit for each grid line, starting from 0. The number of people who waited between 20 and 40 seconds is in one range of 20 – 40 seconds Using the scale, the frequency density for the range of 20 – 40 seconds is 1.05	M1		
		The class width for this range is 40 – 20 = 20 The frequency in this range is 1.05 × 20 = 21	M1		
	21	21 people waited between 20 and 40 seconds for their call to be answered	A1	**5**	
18a		On day 1 there were 1500 bacteria in the Petri dish Growth rate of bacteria is assumed to be an increase of 38% per day On day 3 there will be 1500 × 1.38² = 2856.6 bacteria in the Petri dish	M1 × 1.38 M1 (*their* 1.38)² or × 1.38 twice		R16
	2860	2856.6 is 2860 correct to 3 significant figures	A1		
bi		Day 1 = 1500 bacteria Day 2 = 1500 × 1.38 = 2070 bacteria Day 3 = 2070 × 1.38 = 2856.6 bacteria Day 4 = 2856.6 × 1.38 = 3942.108 bacteria Day 5 = 3942.108 × 1.38 = 5440.10904 bacteria Day 6 = 5440.10904 × 1.38 = 7507.35… bacteria Day 7 = 7507.35… × 1.38 = 10360.14… bacteria	M1 method to find when number will exceed 10,000		R16
	Day 7	The number of bacteria exceeds 10,000 on day 7	A1		
ii	Any suitable comment	**e.g.** if the percentage change is lower, it will take longer for the number of bacteria to exceed 10,000	A1	**6**	R9

Qu №	Answer	Solutions	Marks		Spec.
19a	**'Show That' Qu** *working must be shown*	***Working must be shown*** If the customer choses 1 flavour and 1 topping, for each of the 18 different flavours, there are 13 different toppings they could choose from. There are $18 \times 13 = 234$ options If the customer choses 1 flavour and 1 sauce, for each of the 18 different flavours there are 7 different sauces they could choose from. There are $18 \times 7 = 126$ different combinations If the customer choses 1 flavour, 1 topping and 1 sauce, for each of the 18 different flavours there are 13 different toppings. Foe each of the different flavour and topping combinations, there are 7 sauce options. There are $18 \times 13 \times 7 = 1638$ different possible combinations.	M1		N5
		If a customer orders one scoop of ice cream there are $234 + 126 + 1638$	M1		
		$= 1998$ different possible combinations.	A1		
b		There are 1,998 different scoops of ice cream that could be ordered. After one scoop is ordered, each other person has 1,998 scoops to order from, but only 1 is the same as the first person's order. $\therefore$ P (second person orders same as first) $= \frac{1}{1{,}998}$; P (third person orders same as first) $= \frac{1}{1{,}998}$	M1		P8 P9
	$\frac{1}{3{,}992{,}004}$	P (second person **and** third person order same as first) $= \frac{1}{1{,}998} \times \frac{1}{1{,}998} = \frac{1}{1{,}998^2} = \frac{1}{3{,}992{,}004}$	A1	**5**	

2nd Edition © ZigZag Education, 2017

Qu №	Answer	Solutions	Marks		Spec.
20a		Acceleration $= \dfrac{\text{Velocity}}{\text{Time}} =$ Gradient Acceleration at $t = 17$ is the gradient of the tangent at $t = 17$ 	M1 drawing tangent at $t = 17$		A15
		Gradient $= \dfrac{\text{change in } y}{\text{change in } x} = \dfrac{2.2}{5}$	M1 finding gradient		
	0.44 m/s^2	$= 0.44$ m/s^2	A1 allow ± 0.1		
b		Distance = speed × time = area under the graph  Area of a trapezium $= \dfrac{a+b}{2} \times w$ where a and b are side lengths and w is width of the trapezium Distance in the first section is $\dfrac{1}{2} \times 5 \times 7.2 = 18$ m	M1 starting to find area under curve		A15
		Distance in the second section is $\dfrac{7.2+16}{2} \times 5 = 58$ m Distance in the third section is $\dfrac{16+20.8}{2} \times 5 = 92$ m Distance in the fourth section is $\dfrac{20.8+22.8}{2} \times 5 = 109$ m	M1 method to find area under curve (at least 2 sections)		
	277 m	An estimate for the total distance covered in 20 seconds is 18 + 58 + 92 + 109 = 277 m	A1 allow ± 2	**6**	
			Total Marks: 100		

 2nd Edition © ZigZag Education, 2017