

# Edexcel

GCSE

# Mathematics

SET A – Higher Tier

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# H

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# Answers

## Key to abbreviations used within the answers

- M method mark (e.g. M1 means 1 mark for method)
- A accuracy mark (e.g. A1 means 1 mark for accuracy)
- B independent marks that do not require method to be shown (e.g. B2 means 2 independent marks)

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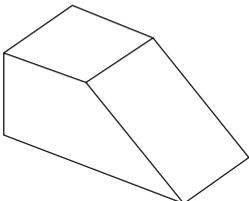
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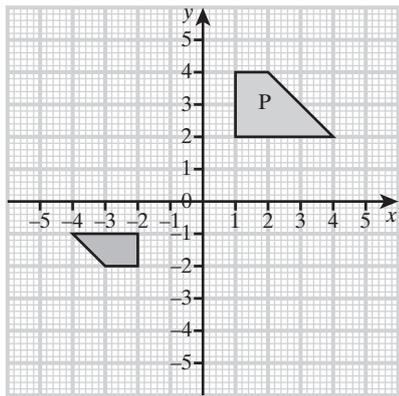
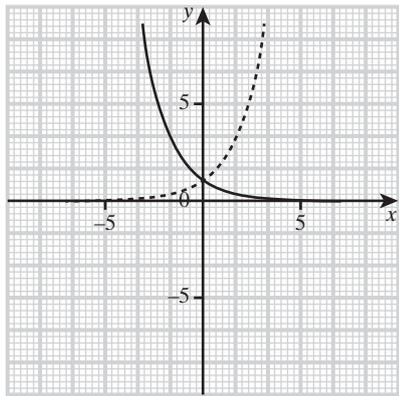
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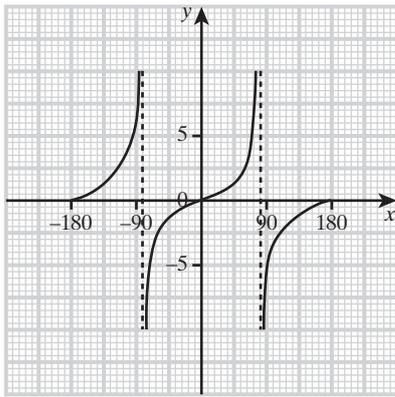
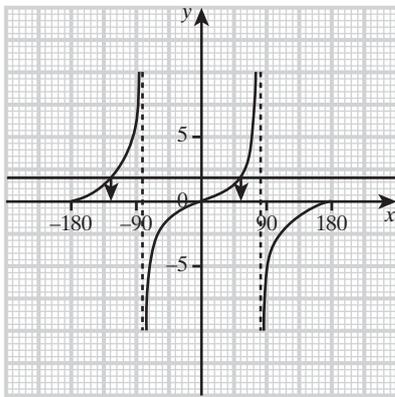
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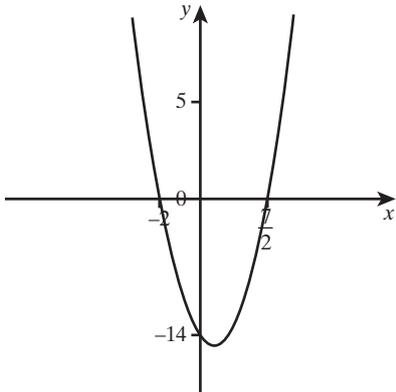
**Paper 1**

Question	Answer	Mark
<b>1</b>	$6 = 2 \times 3$ $15 = 3 \times 5$ $40 = 2 \times 2 \times 2 \times 5$ LCM is $2 \times 2 \times 2 \times 3 \times 5 = 120$	M1 M1 A1
<b>2</b>	$3(x-1) = 6(10-x)$ $3x-3 = 60-6x$ $9x = 63$ $x = 7$	M1 A1 A1
<b>3 (a)</b>		B1
<b>(b)</b>	$\frac{1}{2} \times (6+2) \times 2 \times 2 = 16 \text{ cm}^3$	M1 A1
<b>4</b>	$3 \times 3 \times 2 = 18$	M1 A1
<b>5 (a)</b>	100, 95, 90, 85, 80	B1
<b>(b)</b>	Common difference of $-5$ Sequence is $-5n + c$ $c = 105$ Formula is $-5n + 105$ <b>or</b> $105 - 5n$	M1 A1
<b>6 (a)</b>	$3.3 \times 10^4$	B1
<b>(b)</b>	$8.2 \times 10^{-3}$	B1
<b>(c)</b>	$2 \times 10^{-7}$	B1
<b>7 (a)</b>	$\frac{10}{30} = \frac{1}{3}$	B1
<b>(b)</b>	$\frac{10}{22} = \frac{5}{11}$	B1
<b>(c)</b>	$\frac{17}{20}$	B1
<b>8</b>	$p(3+q) = 3-q$ $3p+pq = 3-q$ $pq+q = 3-3p$ $q(p+1) = 3-3p$ $q = \frac{3-3p}{1+p}$ <b>or</b> $\frac{3(1-p)}{1+p}$	M1 M1 A1
<b>9</b>	$(2x-1)^3 = (2x-1)(2x-1)^2$ $= (2x-1)(4x^2-4x+1)$ $= 2x(4x^2-4x+1) - 1(4x^2-4x+1)$ $= 8x^3 - 8x^2 + 2x - 4x^2 + 4x - 1$ $= 8x^3 - 12x^2 + 6x - 1$	M1 A1 M1 A1

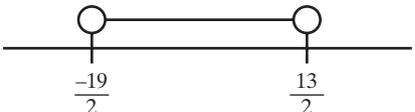
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Question	Answer	Mark
<b>10</b>	 Correct sized shape Correctly positioned	B1 B1
<b>11 (a)</b>	16	B1
<b>(b)</b>	$= \left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{5}{4}\right)^3$ $= \frac{125}{64}$	M1 A1
<b>12 (a)</b>		B1
<b>(b)</b>	$y = 2^{-x}$	B1
<b>13</b>	$2(x^2 - 16)$ $= 2(x+4)(x-4)$	B1 B1
<b>14</b>	$p = 150^\circ$ radius meets tangent at $90^\circ$ ; OABC quadr so $360 - (90 + 90)$ $q = 75^\circ$ angle subtended at centre is twice the angle subtended at the circumference $r = 105^\circ$ opposite angles in cyclic quad sum to $180^\circ$	B1 B1 B1
<b>15 (a)</b>	Cyprus: $27 - 16 = 11$ degrees Majorca: $24 - 17 = 7$ degrees	B1 B1
<b>(b)</b>	Choose Cyprus because the median temperature is highest (comparing median temperatures ( $22 > 19$ )) OR choose Majorca because the temperatures are more consistent (comparing IQ ranges ( $7 < 11$ ))	B1 B1 B1 B1

Question	Answer	Mark
<b>16</b>	$u_1 = 2\sqrt{3}$ $u_2 = 12$ $u_3 = 24\sqrt{3}$ $u_4 = 144$ $u_1 + u_2 + u_3 + u_4 = 2\sqrt{3} + 12 + 24\sqrt{3} + 144$ $= 156 + 26\sqrt{3}$	B1 B1 M1 A1
<b>17 (a)</b>	$2:5 = 6:15$ $3:7 = 15:35$ Brazil : walnut = 6 : 35	B1 B1 B1
<b>(b)</b>	$105 \times \frac{6}{35} = 18$ brazil OR $105 \times \frac{3}{7} \times \frac{2}{5} = 18$ brazil	B1 B1
<b>18</b>	Use short division method to evaluate $7.1 \div 9$ (or equivalent) 0.78888... 0.78	M1 A1 A1
<b>19 (a)</b>	Shape Asymptotes at $\pm 90^\circ$ 	B1 B1
<b>(b)</b>	Draw line through approximately $y = 1.73$  $x = 60^\circ$ $x = -120^\circ$	M1 A1 A1

Question	Answer	Mark
<b>20</b>	$2x^2 - 3x + 5 = 8 - 2x$ $2x^2 - x - 3 = 0$ $(2x - 3)(x + 1) = 0$ $2x - 3 = 0 \Rightarrow x = \frac{3}{2}$ and $y = 5$ $x + 1 = 0 \Rightarrow x = -1$ and $y = 10$	B1 M1 A1 A1 A1 A1 A1
<b>21</b>	$(3n + 1)^2 - (3n - 1)^2$ $= 9n^2 + 6n + 1 - (9n^2 - 6n + 1)$ $= 12n$ $= 6 \times 2n$ so is a multiple of 6	M1 A1 A1
<b>22 (a)</b>	$\sqrt{5}(2 - \sqrt{5})^2 = \sqrt{5}(9 - 4\sqrt{5})$ $= -20 + 9\sqrt{5}$	B1 B1
<b>(b)</b>	$\frac{5}{5 - 3\sqrt{5}} = \left(\frac{5}{5 - 3\sqrt{5}}\right) \left(\frac{5 + 3\sqrt{5}}{5 + 3\sqrt{5}}\right)$ $= \frac{25 + 15\sqrt{5}}{25 - 45} = \frac{25 + 15\sqrt{5}}{-20}$ $= -\frac{5}{4} - \frac{3}{4}\sqrt{5}$	M1 A1 A1
<b>23 (a)</b>	 Correct shape and orientation Intersection points marked at: $(-2, 0)$ $\left(\frac{7}{2}, 0\right)$ $(0, -14)$	B1 A1 A1 A1
<b>(b)</b>	Solution is $(-\infty, -2) \cup \left(\frac{7}{2}, \infty\right)$	B1 B1

Paper 2

Question	Answer	Mark
<b>1 (a)</b>	$510 \leq x < 520$ (cm)	B1
<b>(b)</b>	$\sum \frac{fx}{f} = \frac{(505 \times 2 + 515 \times 6 + 525) \times 1 + 535 \times 4 + 545 \times 3}{16}$ $= \frac{8400}{16} = 525 \text{ cm}$	M1 A1
<b>2</b>	$(6y + 18) + (x - 23) = 180$ $x + 6y = 185$ (1) $2x + (2x - 4y) = 180$ $x - y = 45$ (2) Attempt to solve (1) and (2) simultaneously: $x = 65, y = 20$	M1 A1 A1 M1 A1
<b>3</b>	$-3 < \frac{2x+7}{4} \Rightarrow x > -\frac{19}{2}$ $\frac{2x+7}{4} < 5 \Rightarrow x < \frac{13}{2}$ Solution is $-\frac{19}{2} < x < \frac{13}{2}$ 	B1 B1 B1 B1
<b>4</b>	$1000 \times 1.02 \times 1.0125^4 = \text{£}1072$	M1 A1
<b>5 (a)</b>	Paper 1: 0.7, 0.3 Paper 2: 0.8, 0.2, 0.8, 0.2	B1 B1
<b>(b)</b>	$1 - (0.3 \times 0.2) = 0.94$ (or $0.8 \times 0.7 + 0.8 \times 0.3 + 0.2 \times 0.7$ )	M1 A1
<b>6</b>	$(x+10)(x-9) = 0$ $x = -10$ or $x = 9$	M1 A1 A1
<b>7</b>	$2 \begin{pmatrix} 3 \\ -2 \end{pmatrix} - 3 \begin{pmatrix} -2 \\ -1 \end{pmatrix} = \begin{pmatrix} 6 \\ -4 \end{pmatrix} + \begin{pmatrix} 6 \\ 3 \end{pmatrix}$ $= \begin{pmatrix} 12 \\ -1 \end{pmatrix}$	M1 A1
<b>8 (a)</b>	$AC^2 = 20^2 + 33^2 - 2 \times 20 \times 33 \times \cos 40^\circ$ $AC^2 = 477.82 \dots$ $AC = 21.9 \text{ cm}$	M1 A1 A1
<b>(b)</b>	Area $ABD = \frac{1}{2} \times 20 \times BD \times \sin 20^\circ$ Area $BDC = \frac{1}{2} \times BD \times 33 \times \sin 20^\circ$ So ratio area of triangle $ABD$ : area of triangle $BCD = 20 : 33$	B1 B1 B1

Question	Answer	Mark
<b>9</b>	$y \propto \frac{1}{\sqrt{x}}$ $y = \frac{k}{\sqrt{x}}$ Substitute $x = 16, y = 12.5 \Rightarrow k = 50$ $y = \frac{50}{\sqrt{x}}$ Substitute $x = 0.25 \Rightarrow y = 100$	B1 M1 A1 A1
<b>10</b>	Bisect angle $ABC$ with construction lines Bisect the angle just constructed (with construction lines)	B1 B1
<b>11 (a)</b>	$m = \frac{2}{4} = \frac{1}{2}$ $c = -2$ $y = \frac{1}{2}x - 2$	B1 B1 B1
<b>(b)</b>	Gradient of new line is $-2$ Equation is $y = -2x + c$ Substituting $x = 10, y = 0$ $0 = -20 + c$ $c = 20$ $y = -2x + 20$	B1 M1 A1
<b>12</b>	$0.1 \text{ m}^3 = 100\,000 \text{ cm}^3$ Length scale factor is $\sqrt[3]{27} : \sqrt[3]{125} = 3 : 5$ Area scale factor is $3^2 : 5^2 = 9 : 25$ Required surface area is $100\,000 \times \frac{9}{25} = 36\,000 \text{ cm}^2$	B1 B1 B1 M1 A1
<b>13</b>	Using $11.5 < V < 12.5$ And $13.75 < P < 13.85$ $R_{\min} = \frac{11.5^2}{13.85} = 9.55 \Omega$ $R_{\max} = \frac{12.5^2}{13.75} = 11.4 \Omega$	M1 A1 M1 A1

Question	Answer	Mark
<b>14 (a)</b>	5, 17, 27, 35, 45, 50	B1
<b>(b)</b>	Plot (590, 5), (610, 17)... etc. and join consecutive points with straight lines or a curve	B1 B1
<b>(c)</b>	Draw line from 615 on $x$ -axis, up to line, and across (left) to intersect $y$ -axis at approx. 20 20 hedgehogs underweight implied $50 - 20 = 30$ healthy hedgehogs Percentage of healthy hedgehogs is $\left(\frac{30}{50}\right) \times 100 = 60\%$	M1 A1 A1
<b>15 (a)</b>	$y = \frac{1}{x-2}$ $(x-2)y = 1$ $xy - 2y = 1$ $xy = 1 + 2y$ $x = \frac{1+2y}{y}$ $f^{-1}(x) = \frac{1+2x}{x}$	M1 A1 A1
<b>(b)</b>	$gf(x) = \frac{1}{(x-2)^2}$	B1
<b>(c)</b>	$fg(x) = \frac{1}{x^2-2}$ $(x-2)^2 = x^2 - 2$ $x^2 - 4x + 4 = x^2 - 2$ $x = \frac{3}{2}$	M1 A1
<b>16</b>	$AB = CD$ since opposite sides of a parallelogram are of equal length Angles $BAE$ and $FCD$ are equal, since opposite angles in a parallelogram are equal By SAS rule, $\triangle BAE$ and $\triangle DCF$ are congruent Therefore $BE = FD$ as required	B1 B1 B1 B1

Question	Answer	Mark
<b>17</b>	Volume of hemisphere $= \frac{2}{3}\pi r^3 = \frac{2}{3}\pi(\sqrt{3})^3 = \frac{2}{3}\pi 3\sqrt{3} = 2\sqrt{3}\pi$ Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(3)2\sqrt{3} = 2\sqrt{3}\pi$ Total volume $= 2\sqrt{3}\pi + 2\sqrt{3}\pi = 4\sqrt{3}\pi$	M1 A1 M1 A1 A1
<b>18 (a)</b>	$1.3^4 + 2 \times 1.3 - 7 = -1.54 < 0$ $1.5^4 + 2 \times 1.5 - 7 = 1.0625 > 0$ There is a sign change, so there is a solution between $x = 1.3$ and $x = 1.5$	B1 B1
<b>(b)</b>	$x_0 = 1.4$ $x_1 = 1.4316$ $x_2 = 1.4262$ $x_3 = 1.427$	B1 B1 B1
<b>19</b>	$y = -\frac{b}{2a}$ $= -\left(\frac{-2}{-8}\right)$ $x = -\frac{1}{4}$ $y = 3 - 2\left(-\frac{1}{4}\right) - 4\left(-\frac{1}{4}\right)^2$ $= 3 + \frac{1}{2} - \frac{1}{4}$ $= \frac{13}{4}$ Maximum point is $\left(-\frac{1}{4}, \frac{13}{4}\right)$	M1 A1 M1 A1

**Paper 3**

Question	Answer	Mark
<b>1</b>	$\tan 35^\circ = \frac{12}{x}$ $x = \frac{12}{\tan 35^\circ} = 17.1 \text{ cm}$	M1 A1
<b>2</b>	$\frac{\pounds 21120}{0.88} = \pounds 24000$	M1 A1
<b>3</b>	Using similar triangles $\frac{x+12}{13} = \frac{12}{10.5}$ Solve to give $x = 2.86 \text{ cm}$	M1 A1 A1

Question	Answer	Mark
4	Let $x = 0.1\dot{2}\dot{7} = 0.127272727\dots$ $10x = 1.27272727\dots$ $1000x = 127.272727\dots$ $990x = 126$ $x = \frac{126}{990}$ $= \frac{7}{55}$	B1 B1 M1 A1
5 (a)	Equation – only valid for certain values of $x$	B1
(b)	Identity – true for all values of $x$	B1
(c)	Equation – only valid for certain values of $x$	B1
6	Distance = area under graph $= \left(\frac{1}{2} \times 8 \times 5\right) + (22 \times 5) + \left(\frac{1}{2} \times 4 \times 5\right)$ $= 140\text{m}$	M1 A1 A1
7	Use $A = \frac{\theta}{360} \times \pi r^2$ $\theta = \frac{250 \times 360}{\pi \times 15^2}$ $= 127^\circ$	M1 A1
8 (a)	Summing areas under the bars $25 + 14 + 16 + 4h = 70$ $4h = 15$ $h = 3.75$	M1 A1 A1
(b)	Sum of first two bars' area is 39, so median lies in 2 <sup>nd</sup> bar Suppose the median is $x$ Then by considering areas, $25 + 7(x - 10) = 35$ Solve to give $x = 11.4$	M1 A1
9	$12(x - 3) - 2(x - 2) = 3(x - 2)(x - 3)$ $12x - 36 - 2x + 4 = 3(x^2 - 5x + 6)$ $10x - 32 = 3x^2 - 15x + 18$ $3x^2 - 25x + 50 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{25 \pm \sqrt{25^2 - 4 \times 3 \times 50}}{6}$ $x = 5$ or $x = 3.33$	M1 A1 M1 A1 A1
10 (a)	<b>b - a</b>	B1
(b)	$\frac{1}{n+1}(\mathbf{b} - \mathbf{a})$	B1

Question	Answer	Mark
(c)	$\mathbf{a} + \frac{1}{n+1}(\mathbf{b} - \mathbf{a})$ $= \frac{(n+1)\mathbf{a} + (\mathbf{b} - \mathbf{a})}{n+1}$ $= \frac{n\mathbf{a} + \mathbf{b}}{n+1}$	M1 A1
(d)	$\overline{OD} = \lambda \overline{OC} = \frac{\lambda n}{n+1}\mathbf{a} + \frac{\lambda}{n+1}\mathbf{b}$ Also $\overline{OD} = \overline{OA} + \overline{AD} = \mathbf{a} + \frac{2}{5}\overline{AF}$ $= \mathbf{a} + \frac{2}{5}\left(-\mathbf{a} + \frac{1}{2}\mathbf{b}\right) = \frac{3}{5}\mathbf{a} + \frac{1}{5}\mathbf{b}$ Equating coefficients and solving simultaneously $\frac{\lambda n}{n+1} = \frac{3}{5}$ and $\frac{\lambda}{n+1} = \frac{1}{5}$ $\Rightarrow \lambda = \frac{3(n+1)}{5n}$ and $\lambda = \frac{n+1}{5}$ $\Rightarrow \frac{3(n+1)}{5n} = \frac{n+1}{5}$ $\Rightarrow n = 3$	B1 B1 M1 A1
11 (a)	The graph shows a curve and not a straight line	B1
(b)	Draw a tangent line at the point on the curve where $x = 2$ Select two points on the line and calculate the gradient of the line using $m = \frac{y_2 - y_1}{x_2 - x_1}$ Calculate $m \approx -0.4$ Deceleration $\approx 0.4 \text{ m/s}^2$	M1 A1 A1
12 (a)	$x^4 - 5x^2 - 1 = 0$ $x^4 - 5x^2 + 3 = 4$ $x = -2.3$ or $x = 2.3$	B1 B1 B1
(b)	$x^4 - 5x^2 - x + 2 = 0$ $x^4 - 5x^2 + 3 = x + 1$ $x = -2, x = -0.8, x = 0.6, x = 2.25$	B1 B1 B1
13	RGB may be arranged in $3! = 6$ ways Each arrangement has the probability occurring of $\frac{2}{20} \times \frac{8}{19} \times \frac{10}{18} = \frac{4}{171}$ Total probability is $6 \times \frac{4}{171} = \frac{24}{171}$	B1 M1 A1 M1 A1

Question	Answer	Mark
<b>14 (a)</b>	$2x^2 - 6x + 1$	
	$= 2\left(x^2 - 3x + \frac{1}{2}\right)$	M1
	$= 2\left(\left(x - \frac{3}{2}\right)^2 - \frac{9}{4} + \frac{1}{2}\right)$	M1
	$= 2\left(\left(x - \frac{3}{2}\right)^2 - \frac{7}{4}\right)$	A1
	$= 2\left(x - \frac{3}{2}\right)^2 - \frac{7}{2}$	A1
<b>(b)</b>	Range is $f(x) \geq -\frac{7}{2}, f(x) \in \mathbb{R}$	B1 B1
<b>15</b>	$8 = A \times 5^{-20k}$ (1)	M1
	$1.6 = A \times 5^{-40k}$ (2)	M1
	Equation (1) divide equation (2)	
	$5 = 5^{20k}$	A1
	$20k = 1$	
	$k = \frac{1}{20}$	A1
	Substitute in (1)	
$8 = A \times 5^{-1}$		
$A = 40$	A1	
<b>16</b>	Total surface area $= \pi r^2 + \pi rl$	M1
	$= \pi r^2 + 25\pi r = 600\pi$	A1
	$r^2 + 25r - 600 = 0$	
	$(r + 40)(r - 15) = 0$	M1
	$r = 15$	A1
	$h = \sqrt{25^2 - 15^2} = 20 \text{ cm}$	M1
	Volume of cone $V = \frac{1}{3}\pi r^2 h$	M1
	$V = \frac{1}{3} \times \pi \times 15^2 \times 20$	
	$= 1500\pi \text{ cm}^3$	A1

Question	Answer	Mark
<b>17 (a)</b>	$OA^2 = (2\sqrt{5})^2 + 6^2 = 56$	M1
	Equation of circle is $x^2 + y^2 = 56$	A1
<b>(b)</b>	Gradient of $OA$ is $\frac{6}{2\sqrt{5}} = \frac{3}{\sqrt{5}}$	B1
	Gradient of $AB$ is $-\frac{\sqrt{5}}{3}$	M1
	Equation of $AB$ is $y = -\frac{\sqrt{5}}{3}x + c$	
	Substitute $x = 2\sqrt{5}, y = 6$	M1
	$6 = -\frac{\sqrt{5}}{3}(2\sqrt{5}) + c$	
	$c = \frac{28}{3}$	
	$y = -\frac{\sqrt{5}}{3}x + \frac{28}{3}$	A1
<b>(c)</b>	At $B, y = 0$ , so $x = \frac{28}{\sqrt{5}} = \frac{28\sqrt{5}}{5}$	B1
	Area $OAB = \frac{1}{2}bh$	M1
	$= \frac{1}{2}\left(\frac{28\sqrt{5}}{5}\right)6$	
	$= \frac{84\sqrt{5}}{5}$	A1

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