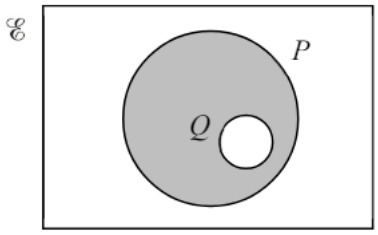
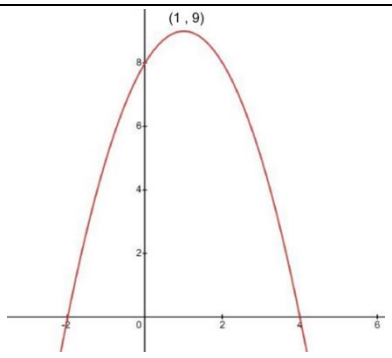
4E5N Mathematics
Prelim Paper 1/2024

Qn	Answer	AO	Marks
1	$12.57 \approx 10$ ….B1	AO1	**1**
2	$\frac{14.75}{0.73} = 20.2054$.....*M*1 $21.99 - 20.2054 \approx \$1.78$.....*A*1(with *units*) *or* $21.99 \times 0.73 = 16.0527$.....*M*1 $16.0527 - 14.75 = £1.30$.....*A*1(with *units*)	AO1	**2**
3(a)	$5(3^3 \times 5^4)^2$ $= 5(3^6 \times 5^8)$ $= 3^6 \times 5^9$.....*B*1	AO1	**1**
3(b)	$2^{100} - 4 \times 2^{97} = 2^k$ $2^{100} - 2^2 \times 2^{97} = 2^k$. $2^{100} - 2^{99} = 2^k$.....*M*1 $2^{99}(2-1) = 2^k \Rightarrow k = 99$.....*A*1	AO2	**2**
4(a)	Factors of 60 :1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 $p = 60$.....*B*1	AO1	**1**
4(b)(i)	$525 = 3 \times 5^2 \times 7$ ……..B1	AO1	**1**
4(b)(ii)	$15 = 3 \times 5 \times 1$ $35 = 1 \times 5 \times 7$ $x = 1 \times 5^2 \times 1$ or $x = 3 \times 5^2 \times 1$ $525 = 3 \times 5^2 \times 7$ $x = 25, 75$ ……B1, B1	AO2	**2**
5	$4540+1328.54 = 4540(1+\frac{r}{100})^{10}$.....*M*1 $(1+\frac{r}{100})^{10} = 1.2926299$ $(1+\frac{r}{100}) = 1.2926299^{0.1}$.....*M*1 $r = 2.6000 \approx 2.60(3sf)$.....*A*1	AO1	**3**
6	Size of each exterior angle = $\frac{180}{9} \times 4 = 80^o$ …..B1	AO3	**2**

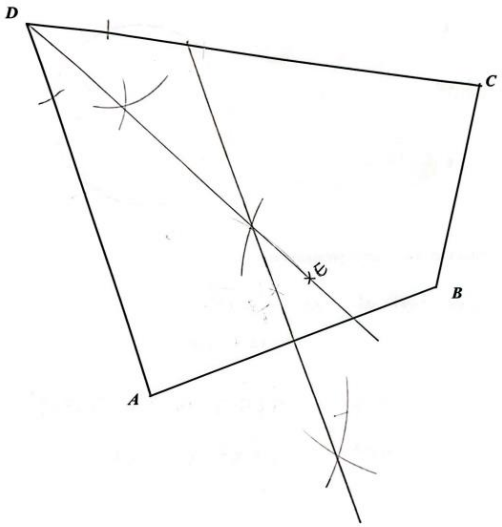
	Since the number of sides = $\frac{360^o}{80^o} = 4.5$ is not a positive integer, therefore it is not possible to form a regular polygon…..B1 OR Let n be number of sides. $(n-2)\times 180 : 360$ $(n-2) : 2$ $2n-4 : 5$ $2n-4=5$ $n=4.5$ OR Exterior + Interior angle = 180 degrees $\frac{(n-2)\times 180}{n} = \frac{5}{9}(180)$ n = 4.5		
7(a)	$x^2+ax+17=(x-6)^2+b$ $x^2+ax+17=x^2-12x+36+b$ Comparing $a=-12$.....*B*1 $17=36+b \Rightarrow b=-19$.....*B*1	AO2	**2**
7(b)	$x^2+ax+17=(x-6)^2+b$ Since the coefficient of $x^2 > 0$, $x^2+ax+17$ is minimum when $(x-6)^2=0$ therefore x = 6.	AO3	**1**
8	New Selling price $= \frac{136}{76}\times 140$.....*M*1 = \$250.53.....*A*1	AO2	**2**
9	Let the number of yellow balls be x Number of blue balls is $4x$ $\frac{x-5}{4x+10} = \frac{1}{6}$.....*M*1 $6(x-5)=4x+10$ $6x-30=4x+10$.....*M*1 $2x=40$ $x=20$ Number of yellow balls = 20.....A1	AO2	**3**

	OR 1 : 4 20 : 80 15 : 90 1 : 6 Ans: 20 OR 1 : 6 15 : 90 20 : 80 1 : 4 Ans: 20 OR Before After 1 : 4 1 : 6 4 : 16 3 : 18 1 unit = 5 4 units = 20 OR Let initial yellow balls be x Let initial blue balls be y $4x = y$ …. (1) $6(x – 5) = y + 10$ … (2) $x = 20$ OR Let initial yellow balls be x Let new yellow balls be y $x – 5 = y$ … (1) $4x + 10 = 6y$ … (2) $x = 20$		
10(a)	$x = -4$ ……B1	AO1	**1**
10(b)	$5y + 10 = mx$ $y = \frac{m}{5}x - 2$ $\frac{m}{5} = \frac{5}{2}$.....*M*1 $m = 12.5$.....*A*1	AO2	**2**
11(a)	78, *a*, *b*, *c*, 42,…..	AO2	**2**

	Common difference = $\frac{78-42}{4}=9$ $a=78-9=69$ $b=69-9=60$ $c=60-9=51$.....*B*2 / *B*1 for any 2 correct		
11(b)	General term = $87-9n$ ……B1	AO2	**1**
11(c)	$87-9n<0$.....*M*1 *o.e* $-9n<-87$ $n>9\frac{2}{3}\Rightarrow n=10$ *First* negative term = $87-90=-3$.....*A*1	AO2	**2**
12(a)	 $P\cap Q'$	AO1	**1**
12(b) (i)	ε = {integer x : $1\le x<15$ } A = {1,4,9} B = {2,3,5,7,11,13} $(A\cup B)'$ = {6, 8, 10, 12, 14} $n(A\cup B)'=5$…..B1	AO1	**1**
12(b) (ii)	B' = {1,4,6,8,9,10,12,14} $A\cap B'=\{1,4,9\}$……..B1 (no mark award for missing curly bracket)	AO1	**1**
12(b) (iii)	C = {1}, {4}, {9}, {1,4}, {1,9} or {4,9} any other possible answers……B1	AO1	**1**
13	 Shape with correct y – intercept (0,8) + x intercepts (-2,0) & (4,0) ……. B2 Coordinates of turning point (1,9) …….. B1	AO1	**3**
14(a)	63……..B1	AO1	**1**

14(b)	72 – 56 = 16……M1, A1	AO1	**2**
14(c)	The spread of marks for the group of foreign students is wider since the interquartile range is higher. **The cumulative frequency curve will be less steep** than the original curve and **passes through (63, 80)** since both groups have the same median.	AO3	**1**
15	$\frac{x}{x+9}-\frac{4x+3}{x^2-81}$ $=\frac{x(x-9)-(4x+3)}{(x+9)(x-9)}$ or $\frac{x(x-9)}{(x+9)(x-9)}-\frac{4x+3}{(x+9)(x-9)}$ *M*1 $=\frac{x^2-9x-4x-3}{(x+9)(x-9)}$ $=\frac{x^2-13x-3}{(x+9)(x-9)}$.....*A*1	AO1	**2**
16(a)	$(2x+3y)(7x-5y)$ $=14x^2-10xy+21xy-15y^2$.....*M*1 $=14x^2+11xy-15y^2$.....*A*1	AO1	**2**
16(b) (i)	$x^3y^3-xy^3$ $=xy^3(x^2-1)$.....*B*1 $=xy^3(x+1)(x-1)$.....*B*1	AO1	**2**
16(b) (ii)	$5ax-3ay-10cx+6cy$ $=a(5x-3y)-2c(5x-3y)$.....*M*1 $=(5x-3y)(a-2c)$.....*A*1	AO1	**2**
17	$AW=BX$ (Given) $\angle WAZ=\angle XBW=90°$ (int angle of a square) $AD-DZ=AB-AW$ ($AW=DZ$ *given*, $AD=AB$ sides of square) $AZ=BW$.....*B*1(for all statements and reasons) By SAS, triangle AWZ is congruent to triangle BXW …..B1	AO3	**2**
18(a)	$y=k\sqrt[3]{x+1}$ $1=k\sqrt[3]{7+1}$.....*M*1 $k=0.5$ $y=0.5\sqrt[3]{124+1}=2.5$.....*A*1	AO1	**2**

18(b)	$F = \frac{k}{d^2}$ $New\ \mathrm{F} = \frac{k}{(0.5d)^2}$.....*B*1 $= 4\left(\frac{k}{d^2}\right) = 4F$ New value of *y* becomes 4 times of the original value……..B1 Other good answers : F increases to 400% of the original value F increases by 300% F increases by 3 times F is increased by a factor of 4 Acceptable answers: F is multiplied by 4	AO2	**2**
19(a)	$1\frac{1}{16} m/s^2$ *or* $1.0625 m/s^2$	AO1	**1**
19(b)	*Ave* Speed $= \frac{0.5(30+13)16+13\times 8}{24}$.....*M*1(correct distance) $= \frac{448}{24}$ $= 18\frac{2}{3} m/s$.....*A*1	AO2	**2**
20(a)	$AB = \begin{pmatrix} 250 & 250 & 100 \\ 400 & 200 & 90 \end{pmatrix}\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 600 \\ 690 \end{pmatrix}$……..B2	AO1	**2**
20(b)	The elements in AB represent the **total** amount of flour, butter and sugar (or **ingredients**) used in making a pandan cake and a marble cake **respectively**…..B1	AO3	**1**
20(c)	$D = \begin{pmatrix} 0.2 \\ x \\ 0.3 \end{pmatrix}$……..B1	AO1	**1**
20(d)	$\frac{250}{100}\times 0.2 + \frac{250}{100}\times x + 0.3 = 4.25$ $x = \$1.38$.....*B*1	AO1	**1**

21	 Perpendicular Bisector – B1 Angle bisector - B1 With correct position of E – B1	AO1	**3**
22	$slant$ height $= \sqrt{(12x)^2 + (17x)^2} = \sqrt{433}x$.....$M1$ $\pi(12x)^2 + \pi(12x)(\sqrt{433}x) = 4\pi(rx)^2$.....$M1$ $144\pi x^2 + 12\sqrt{433}\pi x^2 = 4\pi x^2 r^2$ $4\pi x^2 r^2 = (144 + 12\sqrt{433})\pi x^2$.....$M1$ $r^2 = \dfrac{(144 + 12\sqrt{433})}{4} = 98.42595$ $r = 9.92(3sf)cm$.....$A1$ $(-9.92$rejected$)$	AO2	**4**
23(a)	$\tan 5^o = \dfrac{x}{2.1}$.....$M1$ Length of water level $= 0.9 + 2(2.1\tan 5^o)$.....$M1$ Area of trapezium $= \dfrac{1}{2}(0.9 + 0.9 + 2(2.1\tan 5^o)) \times 2.1 = 2.2758$ m^2....$M1$ Volume of water $= 3.9464 \times 100 = 227.5825 \approx 228$m^3.....$A1$	AO2	**4**
23(b)	$\dfrac{227.5825}{0.3} \div 60 = 12.6434h$ $= 12$ hours 38.60 mins $= 12$ hours 39 mins.....B1	AO1	**1**
24(a) (i)	$\overrightarrow{PL} = \dfrac{1}{3}\overrightarrow{PT}$ $\overrightarrow{PL} = \dfrac{1}{3}(m - p)$.....$B1$	AO1	**1**

24(a) (ii)	$\overrightarrow{KL} = \overrightarrow{KO} + \overrightarrow{OP} + \overrightarrow{PL}$ $\overrightarrow{KL} = -\frac{2}{3}m + p + \frac{1}{3}m - \frac{1}{3}p$ $\overrightarrow{KL} = \frac{2}{3}p - \frac{1}{3}m$.....*B*1	AO2	**1**
24(b)	$\overrightarrow{OM} = \overrightarrow{OK} + \overrightarrow{KM}$ $\overrightarrow{OM} = \frac{2}{3}m - \frac{2}{3}m + \frac{4}{3}p$ $\overrightarrow{OM} = \frac{4}{3}p$.....*B*1 $\overrightarrow{OM} = \frac{4}{3}\overrightarrow{OP}$.....*B*1 Since $\overrightarrow{OM} = \frac{4}{3}\overrightarrow{OP}$ and O is a common point, therefore M lies on OP extended.B1	AO3	**2**
24(c)	$\frac{Area\ KTL}{Area\ OTP} = \frac{Area\ KTL}{Area\ KPT} \times \frac{Area\ KPT}{Area\ OTP}$ $\frac{Area\ KTL}{Area\ OTP} = \frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$.....*B*2(*o.e*)	AO2	**1**
25(a)	*Size* of each int angle = $\frac{(8-2)\times 180^o}{8} = 135^o$.....*M*1 Bearing of H from A = $360^o - 90^o - 135^o = 135^o$.....*A*1	AO2	**2**
25(b)	$BH^2 = 0.65^2 + 0.65^2 - 2(0.65)^2 \cos 135^o$.....*M*1 $BH = \sqrt{1.44250}$.....*M*1 $BH = 1.2010 \approx 1.20km$.....*A*1	AO1	**3**
25(c)	*Area* of $BHG = \frac{1}{2} \times 0.65 \times 1.2010 \times \sin 112.5$.....*M*1 *Area* of $BHG = 0.36061 \approx 0.361km^2$.....*A*1	AO2	**2**

ASSESSMENT OBJECTIVES

The assessment will test candidates' abilities to:

AO1 **Use and apply standard techniques**

- recall and use facts, terminology and notation
- read and use information directly from tables, graphs, diagrams and texts
- carry out routine mathematical procedures

AO2 **Solve problems in a variety of contexts**

- interpret information to identify the relevant mathematics concept, rule or formula to use
- translate information from one form to another
- make and use connections across topics/subtopics
- formulate problems into mathematical terms
- analyse and select relevant information and apply appropriate mathematical techniques to solve problems
- interpret results in the context of a given problem

AO3 **Reason and communicate mathematically**

- justify mathematical statements
- provide explanation in the context of a given problem
- write mathematical arguments

Approximate weightings for the assessment objectives are as follows:

AO1	45%
AO2	40%
AO3	15%