Solution	Marks
REG-2425-MOCK-SET 4-MATH-CP 1	
Suggested solutions	
1. $\dfrac{m^8 n^{-7}}{(m^3 n^{-3})^2} = \dfrac{m^8 n^{-7}}{m^6 n^{-6}}$	1M
$= \dfrac{m^{8-6}}{n^{-6+7}}$	1M
$= \dfrac{m^2}{n}$	1A
2. $\dfrac{3m+2}{n} - p = m$	
$3m + 2 - np = mn$	1M
$m(3-n) = np - 2$	1M
$m = \dfrac{np-2}{3-n}$	1A
3. (a) $49m^2 - 25n^2 = (7m+5n)(7m-5n)$	1A
(b) $49m^2 - 25n^2 - 7m - 5n = (7m+5n)(7m-5n) - (7m+5n)$	1M
$= (7m+5n)(7m-5n-1)$	1A
4. Let the number of students were given two tickets and three tickets be x and y respectively.	
We have $x = 4y$ and $2x + 3y = 220$.	1A+1A
$2(4y) + 3y = 220$	1M
$y = 20$	
Number of students $= 80 + 20 = 100$	1A
5. Let \$$x$ be the cost of the chair.	
Marked price $= x(1+20\%) = \$1.2x$	1M
Selling price $= \$(1.2x - 90)$	1M
$1.2x - 90 = x(1 - 16\%)$	1M
$x = 250$	1A
6. (a) $\angle POR = 310° - 130° = 180°$	1M
Thus, P, O and R are collinear.	1A
(b) Area $= \dfrac{(3+8)(4)\sin(310° - 280°)}{2}$	1M
$= 11$	1A

Solution	Marks
7. (a) Least possible weight $= 700 - \frac{10}{2} = 695$ g	1M+1A
(b) Least total weight $= 695 \times 40$	1M
$= 27.8$ kg	
> 27.75 kg	1M
The claim is disagreed.	1A
8. $\angle DAC = \angle CBD = 25°$	1A
$\angle ADC = 90°$	1A
$\angle ACD = 180° - 90° - 25° = 65°$	1A
$\angle CDE = 128° - 65° = 63°$	1A
9. (a) Let $f(x) = ax + b\sqrt{x}$, where a and b are non-zero constants.	1A
$\begin{cases} 46 = 4a + 2b \\ 188 = 16a + 4b \end{cases}$	1M
Solving, we have $a = 12$ and $b = -1$.	1A
Thus, $f(x) = 12x - \sqrt{x}$.	
(b) Required change $= [12(9) - \sqrt{9}] - [12(16) - \sqrt{16}]$	1M
$= -83$	1A
10. (a) $28 = 159 - (130 + a)$	
$a = 1$	1A
$145 = \frac{131 + 132 + \ldots + 159}{16}$	1M
$b = 1$	1A
Interquartile range $= 151 - 141 = 10$ cm	1A
(b) (i) For group B, interquartile range $= 168 - 157 = 11$ cm > 10 cm.	
The distribution of heights of students in group B is more dispersed than that in group A.	1A
(ii) Median of the distribution in group B (162 cm) is higher than the maximum of the distribution in group A (159 cm).	1M
The claim is agreed.	1A

Solution	Marks
11. (a) $f(x) = (2x^2 - 1)(x + a) + bx - 9$	1M
$\begin{cases} f(1) = 0 = (2-1)(1+a) + b - 9 \\ f(2) = 1 = (8-1)(2+a) + 2b - 9 \end{cases}$	1M
Solving, we have $a = -4$ and $b = 12$.	1A+1A
(b) $f(x) = (2x^2 - 1)(x - 4) + 12x - 9 = 0$	
$2x^3 - 8x^2 + 11x - 5 = 0$	
$(x - 1)(2x^2 - 6x + 5) = 0$	1M
$x = 1$ or $2x^2 - 6x + 5 = 0$	
For $2x^2 - 6x + 5 = 0$, $\Delta = 6^2 - 4(2)(5) = -4 < 0$. The equation has no real roots.	1M
The claim is disagreed.	1A
12. (a) $\angle ACE = \angle BCD$ *(common ∠)*	
$\angle CAE = \angle CBD$ *(given)*	
$\triangle ACE \sim \triangle BCD$ *(AA)*	
Marking Scheme **Case 1** Any correct proof with correct reasons. 2 **Case 2** Any correct proof without reasons. 1	
(b) (i) $\dfrac{BE + 10}{26} = \dfrac{15}{10}$	1M
$BE = 29$ cm	1A
(ii) $BD = \sqrt{39^2 - 15^2} = 36$ cm	1M
Required area $= \dfrac{(36)(26 - 15)}{2}$	
$= 198 \text{ cm}^2$	1A
(iii) $AE = \sqrt{26^2 - 10^2} = 24$ cm	
$AB = \sqrt{24^2 + 29^2} = \sqrt{1417}$ cm	
Let the shortest distance between D and P be h cm.	
$\dfrac{(\sqrt{1417})(h)}{2} = 198$	1M
$h \approx 10.5 > 10$	
There is no such point P.	1A

Solution	Marks
13. (a) $(0,\ 7)$	1A
(b) (i) Let $P(x,\ y)$.	
$\sqrt{x^2+(y-7)^2} = \sqrt{(x-8)^2+(y-1)^2}$	1M
$x^2+y^2-14y+49 = x^2+y^2-16x-2y+65$	
$4x-3y-4=0$	1A
The equation of locus of P is $4x-3y-4=0$.	
(ii) Let the mid-point of AE be F. Then $F(4,\ 4)$.	
$AF = \sqrt{4^2+3^2} = 5$ and radius of $C = \sqrt{7^2-40} = 3 < 5$.	1M
Thus, F lies outside the circle and C does not have any intersection with Γ.	1A
(c) Required ratio $= AH : AE$	
$= 3 : 2 \times 5$	
$= 3 : 10$	1A
14. (a) Volume of prism $= (798)(20) = 15\,960\ \text{cm}^3$	1A
Volume ratio of two pyramids $= 4^{\frac{3}{2}} : 25^{\frac{3}{2}} = 8 : 125$	1M
Volume of smaller pyramid $= 15\,960 \times \dfrac{8}{8+125}$	
$= 960\ \text{cm}^3$	1A
(b) Let the height of the smaller pyramid be h cm.	
$\frac{1}{3}(24)^2(h) = 960$	1M
$h = 5$	
Total surface area of smaller pyramid $= 24^2 + 4 \times \dfrac{24\left[\sqrt{5^2+\left(\frac{24}{2}\right)^2}\right]}{2}$	1M
$= 1200\ \text{cm}^2$	
Required area $= 1200 \times \dfrac{25}{4}$	1M
$= 7500\ \text{cm}^2$	1A
15. (a) Let x marks be the score of Amy in the English examination.	
$\dfrac{x-60}{10} = -0.6$	1M
$x = 54$	1A
(b) Standard score of Amy in the Chinese examination	
$\dfrac{54-59}{8}$	
$= -0.625$	1A
< -0.6	
Amy performs better in the English examination.	
The claim is not correct.	1A

Solution	Marks
16. (a) We have $p + 4p = -a$ and $p(4p) = b$.	1M
$4\left(-\frac{a}{5}\right)^2 = b$	
$4a^2 = 25b$	1
(b) $x^2 + (mx+20)^2 + 16x - 20(mx+20) + 64 = 0$	1M
$(m^2+1)x^2 + (20m+16)x + 64 = 0$	
$x^2 + \left(\frac{20m+16}{m^2+1}\right)x + \frac{64}{m^2+1} = 0$	
Let q be the x-coordinate of Q.	
Then the x-coordinate of P is $4q$.	
q and $4q$ are roots of the equation $x^2 + \left(\frac{20m+16}{m^2+1}\right)x + \frac{64}{m^2+1} = 0$.	
$4\left(\frac{20m+16}{m^2+1}\right)^2 = 25\left(\frac{64}{m^2+1}\right)$	1M
$(5m+4)^2 = 25(m^2+1)$	
$40m - 9 = 0$	
$m = \frac{9}{40}$	1A
17. (a) Required probability $= \frac{C_4^9 + C_4^7}{C_4^{21}}$	1M+1M
$= \frac{23}{855}$	1A
(b) Required probability $= 1 - \frac{23}{855}$	1M
$= \frac{832}{855}$	1A
(c) Required probability $= \frac{C_3^9 C_1^{12} + C_3^7 C_1^{14} + C_3^3 C_1^{18}}{C_4^{21}}$	1M
$= \frac{1516}{5985}$	1A

Solution	Marks
18. (a) $f(x) = x^2 - 4ax + 3a^2 - 1$	
$= [x^2 - 2(2a)x + (2a)^2 - (2a)^2] + 3a^2 - 1$	1M
$= (x - 2a)^2 - a^2 - 1$	
The coordinates of the vertex are $\left(2a,\ -a^2 - 1\right)$.	1A
(b) (i) The coordinates of P and Q are $\left(2a+1,\ -a^2-2\right)$ and $\left(2a+1,\ a^2+2\right)$ respectively.	1M
$PQ = 12$	
$(a^2 + 2) - (-a^2 - 2) = 12$	
$a^2 = 4$	
$a = 2$ or -2 (rejected)	
The coordinates of P and Q are $(5,\ -6)$ and $(5,\ 6)$ respectively.	1A
Note that S lies on the x-axis.	
Let $(s,\ 0)$ be the coordinates of S.	
$\dfrac{0+6}{s-5} \times \dfrac{0-6}{-4-5} = -1$	1M
$s = 1$	
The coordinates of S are $(1,\ 0)$.	1A
(ii) $PR = \sqrt{(-4-5)^2 + (0+6)^2} = \sqrt{117}$	
$QR = \sqrt{(-4-5)^2 + (0-6)^2} = \sqrt{117} = PR$	
We have $\angle PQR = \angle RPQ$.	
Note that $SP \perp PT$ and $SP \perp QR$.	
We have $QR // PT$ and $\angle PRQ = \angle TPQ$.	1M
Thus, $\angle TPQ = \angle PRQ = \angle RPQ$.	
PQ is the angle bisector of $\angle RPT$.	1A

Solution	Marks
19. (a) $AD = \dfrac{\sqrt{30^2+40^2}}{2} = 25\text{ cm}$	
$\angle BAC = \cos^{-1}\dfrac{30}{50} = \cos^{-1}\dfrac{3}{5}$	
$BD^2 = 25^2 + 30^2 - 2(25)(30)\cos\angle BAC$	1M
$BD = 25\text{ cm}$	1A
$\angle ABD = \angle BAD = \cos^{-1}\dfrac{3}{5}$	
$AF = 30\sin\angle ABD = 24\text{ cm}$	1A
$\cos\angle BAF = \dfrac{24}{30} = \dfrac{4}{5}$	
$FE = \dfrac{30}{\cos\angle BAF} - 24 = 13.5\text{ cm}$	1A
(b) (i) Required angle is $\angle AFE$.	
$\cos\angle AFE = \dfrac{13.5}{24}$	1M
$\angle AFE \approx 55.8^\circ$	1A
(ii) Since $AF \perp BD$ and $FE \perp BD$,	
the claim is agreed.	1A
(iii) Area of $\triangle BCD = \dfrac{\text{area of }\triangle ABC}{2}$	
$= \dfrac{(30)(40)}{2\times 2}$	
$= 300\text{ cm}^2$	
Required volume $= \dfrac{1}{3}(300)(24\sin\angle AFE)$	1M
$\approx 1984\text{ cm}^3$	1A
(iv) Area of $\triangle ABD$ is equal to the area of $\triangle BCD$, i.e. 300 cm^2.	
By considering the volume of the tetrahedron,	
$\dfrac{1}{3}(300)(AB\sin\alpha) = \dfrac{1}{3}(300)(BC\sin\beta)$	1M
$\dfrac{\sin\alpha}{\sin\beta} = \dfrac{40}{30} > 1$	
So, $\sin\alpha > \sin\beta$ and therefore $\alpha > \beta$.	1A

END OF PAPER