Solution	Marks
ELITE-2425-MOCK-SET 2-MATH-CP 1	
Suggested solutions	
1. $\dfrac{(x^9y^5)^3}{x^{30}y^{-4}} = \dfrac{x^{27}y^{15}}{x^{30}y^{-4}}$	1M
$= \dfrac{y^{15+4}}{x^{30-27}}$	1M
$= \dfrac{y^{19}}{x^3}$	1A
2. We have $y - x = 123$ and $\dfrac{x}{y} = \dfrac{5}{8}$.	1A
$y - \dfrac{5y}{8} = 123$	1M
$y = 328$	
Required product $= (328 - 123)(328)$	
$= 67\,240$	1A
3. $\dfrac{5m - n}{1 + mn} = 2$	
$5m - n = 2 + 2mn$	1M
$5m - 2mn = 2 + n$	1M
$m = \dfrac{2 + n}{5 - 2n}$	1A
4. (a) Required distance $= 2 \times 55$	1M
$= 110\,\text{m}$	1A
(b) $\tan \angle OPQ = \dfrac{110}{60}$	1M
$\angle OPQ \approx 61.4°$	
Required bearing is N61.4°W.	1A
5. Let the marked price of the bag be $\$x$.	
$x(1 - 10\%) - \dfrac{x}{1 + 25\%} = 75$	2M+1A
$0.1x = 75$	
$x = 750$	1A
Required marked price is \$750.	

Solution	Marks
6. (a) $x - 2 \le 0$	
$x \le 2$	1A
$x - \dfrac{3x+2}{2} < 2$	
$-\dfrac{x}{2} < 3$	
$x > -6$	1A
Thus, we have $-6 < x \le 2$.	1M
(b) 4	1A
7. (a) Let the radius of the smaller hemisphere be r cm.	
$\dfrac{2}{3}\pi r^3 \left(1 + \dfrac{125}{64}\right) = 1008\pi$	1M
$r^3 = 512$	
$r = 8$	1A
(b) Total surface area $= 2\pi(8)^2 + \pi(8)^2$	1M
$= 192\pi \text{ cm}^2$	1A
8. (a) $2.6 = \dfrac{1(9)+2(16)+3(14)+4(8)+5(a)}{9+16+14+8+a}$	1M
$115 + 5a = 122.2 + 2.6a$	
$a = 3$	
Median = 2.5	1A
Mode = 2	1A
(b) Required probability $= \dfrac{14+8+3}{50}$	1M
$= \dfrac{1}{2}$	1A
9. (a) $2.55 \text{ m} \le \text{actual length} < 2.65 \text{ m}$	1M+1A
(b) Least total length of the 180 smaller pieces of ribbon	
$= 180 \times 1.495$	1M
$= 269.1 \text{ cm}$	1A
$> 2.65 \text{ m}$	
The claim is disagreed.	1A

Solution	Marks
10. (a) Γ is the perpendicular bisector of AB.	1A
(b) (i) $\sqrt{(x-11)^2+(y-17)^2}=\sqrt{(x+7)^2+(y+1)^2}$	1M
$-36x-36y+360=0$	
$x+y-10=0$	1A
(ii) Let $(h,\ k)$ be the centre of the circle.	
Since the centre lies on Γ, we have $h+k-10=0$.	1M
Note that the centre is equidistant from A and D.	
$\sqrt{(h-11)^2+(k-17)^2}=\sqrt{(h+1)^2+(k-11)^2}$	1M
$-24h-12k+288=0$	
$2h+k-24=0$	
Solving, we have $h=14$ and $k=-4$.	
Required coordinates are $(14,\ -4)$.	1A
11. (a) Mean $=\dfrac{2.7+3.1+2.9+2.8+3.4+2.8+3.3}{7}$	
$=3\text{ kg}$	1A
Range $=3.4-2.7$	
$=0.7\text{ kg}$	1A
(b) (i) Let x kg be the required total weight.	
$\dfrac{7(3)+3.3+3.4+x}{11}=3$	1M
$x=5.3$	1A
(ii) Let a kg and b kg be the weights of the two newly-added baby girls.	
Suppose the range remains unchanged, we have $2.7\le a\le 3.4$ and $2.7\le b\le 3.4$.	1M
We have $a+b\ge 2.7+2.7=5.4$, which is a contradiction.	
Thus, it is not possible.	1A

Solution	Marks
12. (a) $\angle CFE = 90°$ *(given)*	
$\angle CFB = 90°$ *(given)*	
$\angle DFE = \angle CFB = 90°$ *(vert. opp. ∠s)*	
$\angle CED = 90°$ *(prop. of rectangle)*	
$\angle FED = 90° - \angle CEF$	
$\angle CEF + \angle EFC + \angle FCE = 180°$ *(∠ sum of △)*	
$\angle CEF + 90° + \angle FCE = 180°$	
$\angle FCE = 90° - \angle CEF$	
$= \angle FED$	
$\triangle CEF \sim \triangle EDF$ *(AA)*	

Marking Scheme		
Case 1	Any correct proof with correct reasons.	2
Case 2	Any correct proof without reasons.	1

Solution	Marks
(b) (i) Note that $CE = AD = BC$ and $CF \perp BE$.	1M
We have $BF = EF$.	
F is the mid-point of BE.	1
(ii) $EF = BF = 12\text{ cm}$	
$CF = \sqrt{15^2 - 12^2} = 9\text{ cm}$	1M
Since $\triangle CEF \sim \triangle EDF$.	
$\frac{ED}{CE} = \frac{EF}{CF}$	
$\frac{ED}{15} = \frac{12}{9}$	1M
$ED = 20\text{ cm}$	1A

Solution	Marks
13. (a) Let $f(x) = a + b(x-2)(x-1)$, where a and b are non-zero constants.	1A
$\begin{cases} 16 = a + b(10-2)(10-1) \\ -50 = a + b(4-2)(4-1) \end{cases}$	1M
Solving, we have $a = -56$ and $b = 1$.	
$0 = -56 + (x-2)(x-1)$	1M
$0 = x^2 - 3x - 54$	
$x = 9$ or -6	
The x-intercepts are 9 and -6.	1A
(b) (i) $x = \frac{3}{2}$	1A
(ii) The coordinates of A and B are $(-6,\ 0)$ and $(9,\ 0)$ respectively.	
The coordinates of C are $(0,\ -54)$.	
$-54 = -56 + (x-2)(x-1)$	
$0 = x^2 - 3x$	
$x = 0$ or 3	
The coordinates of D are $(3,\ -54)$.	
The area of the polygon is the least when the coordinates of Q are $\left(\frac{3}{2},\ -\frac{1}{4}\right)$.	1M
Minimum area of the polygon $ACDBQ$	
$= \frac{[(9+6)+(3-0)](54)}{2} - \frac{(9+6)\left(\frac{1}{4}\right)}{2}$	1M
$= 484.125$	
< 485	
The claim is disagreed.	1A

Solution	Marks
14. (a) Let h cm be the required height.	
Note that the length of the square base of the smaller square pyramid is also h cm.	1M
$27 \times \frac{1}{3} \times h^2 \times h = 4 \times \left[12^3 - \frac{1}{3} \times 12^2 \times 12\right]$	1M
$h^3 = 512$	
$h = 8$	1A
(b) Required ratio $= 8^2 : 12^2$	1M
$= 4 : 9$	1A
(c) Let k cm be the length of the metal cube and H cm be the height of the smaller square pyramid.	
The height of the largest square pyramid is k cm.	
$27 \times \frac{1}{3} \times H^2 \times H = 4 \times \left[k^3 - \frac{1}{3} \times k^2 \times k\right]$	1M
$\left(\frac{H}{k}\right)^3 = \frac{8}{27}$	
$\frac{H}{k} = \frac{2}{3}$	
The ratio in (b) becomes $2^2 : 3^2 = 4 : 9$, which is the same as before.	1M
The claim is disagreed.	1A
15. (a) Standard score $= \frac{74 - 64}{4}$	1M
$= 2.5$	1A
(b) Standard score of Samuel after the adjustment	
$= \frac{74(1 + 10\%) - 64(1 + 10\%)}{4(1 + 10\%)}$	1M
$= 2.5$	
< 2.75	
Sophia performs better in the test.	1A
16. (a) Required probability $= \frac{C_1^4 \times C_3^5}{C_4^9}$	1M
$= \frac{20}{63}$	1A
(b) Required probability $= 1 - \frac{20}{63} - \frac{C_3^4 \times C_1^5}{C_4^9}$	1M
$= \frac{11}{21}$	1A

Solution	Marks
17. (a) Let G be the centre of the circle.	
The coordinates of G are $(3,\ -2)$.	
Slope of $AG = \frac{-1+2}{1-3} = -\frac{1}{2}$	
Required equation is	
$y+1 = 2(x-1)$	1M
$2x - y - 3 = 0$	1A
(b) (i) The equation of L is $y = 2x + b$.	1M
$x^2 + (2x+b)^2 - 6x + 4(2x+b) + 8 = 0$	
$5x^2 + (4b+2)x + (b^2+4b+8) = 0$	
L and C intersect at two distinct points.	
$(4b+2)^2 - 4(5)(b^2+4b+8) > 0$	1M
$-4b^2 - 64b - 156 > 0$	
$-13 < b < -3$	1A
(ii) Let the equation of L' be $y = 2x + k$.	
$5x^2 + (4k+2)x + (k^2+4k+8) = 0$	
x_1 and x_2 are roots of the quadratic equation.	
$x_1 x_2 = 4$	
$\frac{k^2+4k+8}{5} = 4$	1M
$k^2 + 4k - 12 = 0$	
$k = -6$ or 2 (rejected)	1A
The equation of L' is $y = 2x - 6$.	

Solution	Marks
18. (a) $75^2 = 29^2 + 92^2 - 2(29)(92)\cos\angle ABC$	1M
$\cos\angle ABC = \dfrac{20}{29}$	
$BD = 29\cos\angle ABC = 20\text{ cm}$	1A
$AD = \sqrt{29^2 - 20^2} = 21\text{ cm}$	1A
(b) (i) Required angle is $\angle BDC$.	1M
$BC^2 = 75^2 + 29^2 - 2(75)(29)\cos 60°$	1M
$BC = \sqrt{4291}\text{ cm}$	
$CD = 92 - 20 = 72\text{ cm}$	
$BC^2 = 72^2 + 20^2 - 2(72)(20)\cos\angle BDC$	
$\angle BDC \approx 63.3°$	1A
(ii) Required volume	
$= \dfrac{1}{3} \times \left(\dfrac{20 \times 21}{2}\right) \times 72\sin\angle BDC$	1M
$\approx 4500\text{ cm}^3$	1A

Solution	Marks
19. (a) $f(x) = x^2 - (8k+6)x + 16k^2 + 22k + 5$	
$= [x^2 - 2(4k+3)x + (4k+3)^2] - 2k - 4$	1M
$= [x - (4k+3)]^2 - 2k - 4$	
The coordinates of M are $(4k+3,\ -2k-4)$.	1A
(b) (i) $(4k+9,\ 2k+4)$	1A
(ii) Since P is the orthocentre of $\triangle PMN$, we have $\angle MPN = 90°$.	1M
$\dfrac{y-(-2k-4)}{x-(4k+3)} \times \dfrac{y-(2k+4)}{x-(4k+9)} = -1$	1M+1M
$y^2 - (2k+4)^2 = -[x-(4k+3)][x-(4k+9)]$	
$x^2 + y^2 - (8k+12)x + 12k^2 + 32k + 11 = 0$	1A
(iii) UV is the perpendicular bisector of MN.	
The coordinates of the mid-point of MN are $(4k+6,\ 0)$.	
Slope of $MN = \dfrac{(2k+4)-(-2k-4)}{(4k+9)-(4k+3)} = \dfrac{2k+4}{3}$	
Required equation is	
$y - 0 = -\dfrac{3}{2k+4}[x-(4k+6)]$	1M
$y = -\dfrac{3x}{2k+4} + \dfrac{3(2k+3)}{k+2}$	1A
(iv) Note that $MN^2 = MU^2 + NU^2 = 2MU^2$.	
Area of square $MUNV$	
$= MU^2$	
$= \dfrac{MN^2}{2}$	1M
$= \dfrac{1}{2}[((4k+9)-(4k+3))^2 + ((2k+4)+(2k+4))^2]$	
$= \dfrac{1}{2}[36 + (4k+8)^2]$	1M
$= 18 + 8(k+2)^2$	
≥ 18	
The claim is agreed.	1A

END OF PAPER