Solution	Marks
ELITE-2425-MOCK-SET 11-MATH-CP 1	
Suggested solutions	
1. $m^8\left(\frac{n^{-2}}{m^3}\right)^3 = m^8 \times \frac{n^{-6}}{m^9}$	1M
$= \frac{1}{m^{9-8}n^6}$	1M
$= \frac{1}{mn^6}$	1A
2. $2x^2 - 8x(y-z)^2 = 2x[x^2 - 4(y-z)^2]$	1M
$= 2x[x+2(y-z)][x-2(y-z)]$	
$= 2x(x+2y-2z)(x-2y+2z)$	1M+1A
3. $\frac{2-m}{2} = \frac{5n+3m}{n}$	
$2n - mn = 10n + 6m$	1M
$-mn - 6m = 8n$	1M
$m = \frac{-8n}{n+6}$	1A
4. Let the number of cartons of orange juice and pineapple juice be x and y respectively.	
$\begin{cases} x + y = 50 \\ \frac{x}{5} - \frac{y}{5} = 4 \end{cases}$	1M 1M
Solving,	
$\frac{50-y}{5} - \frac{y}{5} = 4$	1M
$50 - 2y = 20$	
$y = 15$	1A
There are 15 cartons of pineapple juice on the bench.	
5. (a) $\frac{3x-2}{5} > x - 6$	
$-\frac{2x}{5} > -\frac{28}{5}$	
$x < 14$	1A
$3x - 12 \geq 0$	
$x \geq 4$	1A
Thus, $4 \leq x < 14$.	1M
(b) 10	1A

Solution	Marks
6. (a) The coordinates of A and C are $(2,\ 0)$ and $(8,\ -8)$ respectively.	1A+1A
(b) $AB = \sqrt{(8-2)^2 + 8^2} = 10$	1M
$AC = \sqrt{(8-2)^2 + (-8)^2} = 10 = AB$	
The lengths of AB and AC are equal.	1A
7. (a) 60.5 marks	1A
(b)	2A

Score	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80
Class mark	35.5	45.5	55.5	65.5	75.5
Number of students	5	5	10	15	5

Mean mark $= \dfrac{35.5 \times 5 + 45.5 \times 5 + \ldots + 75.5 \times 5}{40}$	
$= 58$	1A
8. (a) Let $W = kL^3$, where k is a non-zero constant.	1A
$75 = k \times 5^3$	1M
$k = \dfrac{3}{5}$	1A
Thus, $W = \dfrac{3L^3}{5}$.	
(b) Required percentage $= \dfrac{\frac{3}{5}[L(1+60\%)]^3 - \frac{3}{5}L^3}{\frac{3}{5}L^3} \times 100\%$	1M
$= +309.6\%$	1A
9. (a) Maximum absolute error $= 16 \times 1\% = 0.16$ mm.	1M
Denote the length of a quality component by L mm.	
Then $15.84 \le L < 16.16$.	1M+1A
(b) Since $16.20\text{ mm} > 16.16\text{ mm}$,	1M
it is not a quality component.	1A

Solution | Marks

10. (a) $\angle ADE = 90^\circ$ (given)

$\angle ABC = 90^\circ$ (given)

$= \angle ADE$

$\angle EAD = \angle CAB$ (common $\angle$)

$\triangle ADE \sim \triangle ABC$ (AA)

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

(b) $EB = AE = 20\,\text{cm}$. 1A

$DE = \sqrt{20^2 - 16^2} = 12\,\text{cm}$ 1M

Since $\triangle ADE \sim \triangle ABC$,

$$\frac{BC}{AB} = \frac{DE}{AD}$$

$$\frac{BC}{20+20} = \frac{12}{16}$$ 1M

$$BC = 30\,\text{cm}$$

Since $\angle CBE = 90^\circ$, CE is a diameter of the required circle. 1M

Let the radius of the circle be r.

$$(2r)^2 - 20^2 = 30^2$$

$$r^2 = 325$$

Required area is $r^2\pi = 325\pi\,\text{cm}^2$. 1A

11. (a) $(50+b) - 21 = 32$ 1M

$b = 3$ 1A

$37 - (20+a) = 9$

$a = 8$ 1A

Mean of the distribution $= \dfrac{21+23+\ldots+53}{18} = 33.5$ 1A

Standard deviation of the distribution ≈ 8.73 1A

(b) Original median of the distribution = 33

Age of the new teacher = 33 1A

Change in standard deviation $\approx 8.49 - 8.73$

≈ -0.232 1A

Solution	Marks
12. (a) $\frac{OM}{ON} = \frac{AM}{ND}$	
$\frac{13.5 - ON}{ON} = \frac{5}{4}$	1M
$ON = 6\,\text{cm}$	
Required volume $= \frac{1}{3}\pi(4)^2(6)$	1M
$= 32\pi\,\text{cm}^3$	1A
(b) Since the volume of milk is greater than the volume of the lower cone,	
there are $36\pi - 32\pi = 4\pi\,\text{cm}^3$ of milk in the upper cone.	
Let the height of milk in the upper cone be h cm.	
$\left(\frac{h}{6}\right)^3 = \frac{4\pi}{32\pi}$	1M
$h = 3$	
Curved surface area of the lower cone	
$= \pi(4)(\sqrt{4^2 + 6^2})$	1M
$= 8\sqrt{13}\pi$	
Total wet curved surface area	
$= 8\sqrt{13}\pi \times \left(\frac{3}{6}\right)^2 + 8\sqrt{13}\pi$	1M
$= 10\sqrt{13}\pi\,\text{cm}^2$	
$> 36\pi\,\text{cm}^2$	
The claim is agreed.	1A
13. (a) $(x-6)^2 + (y+5)^2 = 6^2 + 5^2$	1M
$(x-6)^2 + (y+5)^2 = 61$	1A
(b) (i) $H = (12,\ 0)$ and $K = (0,\ -10)$	1A+1A
(ii) O, P and Q are collinear.	1A
(iii) Required area $= 12 \times 10$	1M
$= 120$	1A

Solution	Marks
14. (a) $f(-1) = h = -h - 1 + 9 + k$	1M
$2h - k = 8$	
$0 = f\left(\frac{1}{2}\right) = \frac{h}{8} - \frac{1}{4} - \frac{9}{2} + k$	1M
$h + 8k = 38$	
Solving, we have $h = 6$ and $k = 4$.	1A+1A
(b) $f(x) = 6$	
$6x^3 - x^2 - 9x - 2 = 0$	
$(x + 1)(6x^2 - 7x - 2) = 0$	1M
$x = -1$ or $\frac{7 \pm \sqrt{7^2 - 4(6)(-2)}}{2(6)}$	1M
$= -1$ or $\frac{7 \pm \sqrt{97}}{12}$	
There are some irrational roots in $f(x) = 6$.	
The claim is disagreed.	1A
15. (a) $6 = ka^0$	
$k = 6$	1A
$54 = 6 \times a^{-2}$	
$a^2 = \frac{1}{9}$	
$a = \frac{1}{3}$	1A
(b) $f(x_1) = \frac{3}{f(x_2)}$	
$6 \times \frac{1}{3^{x_1}} = \frac{3}{6 \times \frac{1}{3^{x_2}}}$	1M
$3^{x_1 + x_2} = 12$	
$(x_1 + x_2) \log 3 = \log 12$	1M
$x_1 + x_2 \approx 2.26$	1A
16. (a) Let the common difference be d.	
$2014 + 15d = 1729$	1M
$d = -19$	1A
(b) $S(n) = \frac{n}{2}[2(2014) + (n - 1)(-19)] < 0$	1M
$-19n^2 + 4047n < 0$	
$n < 0$ (rejected) or $n > 213$	1A
The least value of n is 214.	1A

Solution	Marks
17. (a) Required probability $= \dfrac{C^{18}_{6}}{C^{20}_{8}}$	1M
$= \dfrac{14}{95}$	1A
(b) Required probability $= \dfrac{C^{10}_{8}(C^{2}_{1})^{8}}{C^{20}_{8}}$	1M
$= \dfrac{384}{4199}$	1A
(c) Required probability $= \dfrac{C^{10}_{2}C^{8}_{4}(C^{2}_{1})^{4}}{C^{20}_{8}}$	1M
$= \dfrac{1680}{4199}$	1A
18. (a) When $y = 0$, $3x^2 - 6mx + 4m^2 = 0$.	
$\Delta = (6m)^2 - 4(3)(4m^2)$	1M
$= -12m^2$	
< 0	
The graph has no x-intercepts.	1
(b) $y = f(x)$	
$= 3(x^2 - 2mx + m^2) + m^2$	1M
$= 3(x - m)^2 + m^2$	
The coordinates of the vertex are $\left(m,\ m^2\right)$.	1A
(c) Coordinates of A and B are $\left(m,\ m^2\right)$ and $(m,\ 0)$ respectively.	1A
Since $\angle OBA = 90°$, the circumcentre is the mid-point of OA.	
The coordinates of circumcentre are $\left(\dfrac{m}{2},\ \dfrac{m^2}{2}\right)$.	1A
When $m = 2$, the coordinates of circumcentre are $(1,\ 2)$ which does not lie on $y = x$.	1M
The claim is incorrect.	1A

Solution	Marks
19. (a) In $\triangle ABC$,	
$BC^2 = 5^2 + 10^2 - 2(5)(10)\cos 80°$	1M
$BC \approx 10.4\text{ cm}$	
$5^2 = 10^2 + BC^2 - 2(10)(BC)\cos \angle ABD$	
$\angle ABD \approx 28.3°$	
In $\triangle ABD$,	
$BD = 10\cos \angle ABD$	1M
$\approx 8.80\text{ cm}$	1A
$DC = BC - BD \approx 1.57\text{ cm}$	1A
(b) (i) In $\triangle ABC$, when $\theta = 45°$,	
$BC^2 = 10^2 + 5^2 - 2(10)(5)\cos 45°$	1M
$BC \approx 7.37\text{ cm}$	1A
The angle between the faces ABD and ADC is $\angle BDC$.	1A
In $\triangle BDC$,	
$BC^2 = BD^2 + CD^2 - 2(BD)(CD)\cos \angle BDC$	
$\angle BDC \approx 22.1°$	1A
$< 25°$	
The claim is agreed.	1A
(ii) In $\triangle ABC$, when $\theta = 40°$,	
$BC^2 = 10^2 + 5^2 - 2(10)(5)\cos 40°$	
$BC \approx 6.96\text{ cm}$	
So, $BC + CD \approx 8.53\text{ cm} < BD$.	1M
This violates the triangle inequality, implying that this situation is impossible.	1

END OF PAPER