Solution	Marks

REG-2425-MOCK-SET 7-MATH-CP 1
Suggested solutions

Solution	Marks
1. $\frac{xy^7}{(x^2y^{-3})^4} = \frac{xy^7}{x^8y^{-12}}$	1M
$= \frac{y^{7+12}}{x^{8-1}}$	1M
$= \frac{y^{19}}{x^7}$	1A
2. $k = \frac{5x-6y}{y}$	
$ky = 5x - 6y$	1M
$y(k+6) = 5x$	1M
$y = \frac{5x}{k+6}$	1A
3. Mean = 0.85	1A
Median = 1	1A
Interquartile range = 1.5 − 0 = 1.5	1A
4. (a) $x^2 - 4xy + 4y^2 = (x-2y)^2$	1A
(b) $3x^2 - 5xy - 2y^2 = (x-2y)(3x+y)$	1A
(c) $4x^2 - 9xy + 2y^2 - 6x + 12y = (x-2y)(4x-y) - 6(x-2y)$	1M
$= (x-2y)(4x-y-6)$	1A
5. (a) $5(x-2) \geq \frac{11x-34}{3}$	
$\left(5 - \frac{11}{3}\right)x \geq \frac{-34}{3} + 10$	
$x \geq -1$	1A
$9 - x > 5$	
$x < 4$	1A
So, $-1 \leq x < 4$.	1M
(b) 5	1A
6. $\frac{(15-x)(15-x+10)}{2} = 252$	1M+1A
$\frac{x^2}{2} - 20x - \frac{129}{2} = 0$	1A
$x = -3$ or 43 (rejected)	1A

Solution	Marks
7. (a) $\frac{x}{360°} = \frac{1}{10}$	1M
$x = 36°$	1A
(b) Let the number of students in the school be n.	
$\frac{152}{n} = \frac{360° - 158° - 90° - 36°}{360°}$	1M
$n = 720$	1A
There are 720 students in the primary school.	
8. (a) Let $f(x) = ax + bx^2$, where a and b are non-zero constants.	1A
$\begin{cases} 72 = 2a + (2)^2 b \\ -60 = -a + (-1)^2 b \end{cases}$	1M
Solving, we have $a = 52$ and $b = -8$.	1A
So, $f(x) = 52x - 8x^2$.	
(b) $52x - 8x^2 = 260$	
$-8x^2 + 52x - 260 = 0$	
$\Delta = 52^2 - 4(-8)(-260) = -5616 < 0$	1M
So, the equation has zero real roots.	1A
9. (a) $A'(0,\ 6)$ and $B'(5,\ 3)$.	1A+1A
(b) Slope of $AB = \frac{-6-3}{0+5} = \frac{-9}{5}$	1A
(c) Slope of $A'B' = \frac{6-3}{0-5} = -\frac{3}{5} \neq \frac{-9}{5}$.	1M
The lines $A'B'$ and AB intersect at one point.	
The claim is disagreed.	1A
10. (a) $43 = (80 + b) - 42$	
$b = 5$	1A
$59 = \frac{42 + 42 + 44 + \ldots + (50 + a) + \ldots + 85}{20}$	
$a = 7$	1A
Median = 58 min	1A
(b) Required probability $= \frac{9}{15}$	1M
$= \frac{3}{5}$	1A

Solution	Marks
11. (a) Volume of cylinder $= \pi(14)^2(182)$	
$= 35672\pi \text{ cm}^3$	1A
Ratio of volume of two cones $= 9^{\frac{3}{2}} : 16^{\frac{3}{2}} = 27 : 64$.	1M
Volume of the larger cone $= 35\,672\pi \times \dfrac{64}{27+64}$	
$= 25088\pi \text{ cm}^3$	1A
(b) Let the base radius of the larger cone be r cm.	
$\dfrac{1}{3}\pi r^2(96) = 25\,088\pi$	1M
$r = 28$ or -28 (rejected)	
Curved surface area of the larger cone	
$= \pi(28)\sqrt{28^2+96^2}$	1M
$= 2800\pi \text{ cm}^2$	
Required area $= 2800\pi \times \dfrac{9}{16}$	
$= 1575\pi \text{ cm}^2$	1A
12. (a) $(x-7)^2+(y+3)^2 = (-8-7)^2+(5+3)^2$	1M
$(x-7)^2+(y+3)^2 = 289$	1A
(b) $JK = \sqrt{(7+1)^2+(-3-25)^2} = \sqrt{848} >$ radius of C.	1M
So, J lies outside the circle.	1A
(c) (i) J, K and P are collinear.	1A
(ii) Slope of the line $= \dfrac{25+3}{-1-7} = -\dfrac{7}{2}$.	
Required equation is	
$y - 25 = -\dfrac{7}{2}(x+1)$	1M
$7x + 2y - 43 = 0$	1A

Solution	Marks
13. (a) Let $f(x) = (x^2 - 4)(Ax + B) + (kx + 126)$, where A and B are constants.	1M
$f(2) = 0 = 0 + 2k + 126$	1M
$k = -63$	1A
(b) $f(x) = (x^2 - 4)(Ax + B) - 63x + 126$.	
$\begin{cases} f(1) = 0 = (1-4)(A+B) - 63 + 126 \\ f(0) = 30 = (0-4)(B) + 126 \end{cases}$	1M
Solving, we have $A = -3$ and $B = 24$.	1A
$f(x) = (x^2 - 4)(-3x + 24) - 63x + 126 = 0$	
$-3x^3 + 24x^2 - 51x + 30 = 0$	
$(x - 1)(-3x^2 + 21x - 30) = 0$	1M
$(x - 1)(x - 2)(-3x + 15) = 0$	
$x = 1$ or 2 or 5	1A
The claim is correct.	1A

Solution	Marks
14. (a) (i) $BC = CB$ (common side)	
$\angle GBC = \angle FCB$ (alt. $\angle$s, $BG // EC$)	
$\angle GCB = \angle FBC$ (alt. $\angle$s, $CG // DB$)	
$\triangle BCG \cong \triangle CBF$ (ASA)	

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

Solution	Marks
(ii) $DE // BC$ (prop. of rectangle)	
$\angle EFD = \angle CFB$ (vert. opp. $\angle$s)	
$\angle FDE = \angle FBC$ (alt. $\angle$s, $DE // BC$)	
$\triangle BCF \sim \triangle DEF$ (AA)	

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

Solution	Marks
(b) (i) $\angle BDC = 60°$ and $\angle DBC = 30°$.	1A
$DF = BD - BF$	
$= \dfrac{k}{\cos 30°} - k\cos 30°$	1M
$= \dfrac{2k\sqrt{3}}{3} - \dfrac{k\sqrt{3}}{2}$	
$= \dfrac{\sqrt{3}k}{6}$	1A
(ii) $AE = AD - DE$	
$= k - \dfrac{DF}{\cos 30°}$	
$= \dfrac{2k}{3}$	1M
$AE : DF = \dfrac{2k}{3} : \dfrac{\sqrt{3}k}{6}$	
$= 4 : \sqrt{3}$	1A
15. Slope $= \dfrac{2}{4} = \dfrac{1}{2}$	
$\log_{16} y = \dfrac{1}{2}x - 2$	1M
$y = 16^{\frac{x}{2} - 2}$	1M
$= \dfrac{1}{256} \cdot 4^x$	
So, $a = \dfrac{1}{256}$ and $b = 4$.	1A

Solution	Marks
16. (a) Let the common ratio be r.	
$\begin{cases} G_1 r + G_1 r^2 = 1944 \\ G_1 r^4 + G_1 r^5 = 72 \end{cases}$	
$\dfrac{G_1 r^4 (1+r)}{G_1 r (1+r)} = \dfrac{72}{1944}$	1M
$r^3 = \dfrac{1}{27}$	
$r = \dfrac{1}{3}$	1A
So, $G_1 = \dfrac{1944}{r + r^2} = 4374$.	1A
(b) $\dfrac{4374}{1 - \frac{1}{3}} - \dfrac{4374\left[1 - \left(\frac{1}{3}\right)^n\right]}{1 - \frac{1}{3}} < 5 \times 10^{-19}$	1M+1M
$6561\left(\dfrac{1}{3}\right)^n < 5 \times 10^{-19}$	
$\log 6561 + n \log \dfrac{1}{3} < \log 5 \times 10^{-19}$	1M
$n > 46.4$	
The least value of n is 47.	1A
17. (a) $f(x) = x^2 - 6kx + 12k^2 + 6$	
$= (x^2 - 6x + 9k^2) + 3k^2 + 6$	1M
$= (x - 3k)^2 + 3k^2 + 6$	
The coordinates of vertex are $\left(3k,\ 3k^2 + 6\right)$.	1A
(b) $P\left(3k - 3,\ 3k^2 + 6\right)$ and $Q\left(3k + 3,\ -3k^2 - 6\right)$.	1A
Consider the the distances from point $(0,\ 6)$ to P and to Q.	
$\sqrt{(3k-3)^2 + (3k^2)^2} = \sqrt{(3k+3)^2 + (-3k^2 - 6 - 6)^2}$	1M
$-72k^2 - 36k - 144 = 0$	
$\Delta = 36^2 - 4(-72)(-144) = -40\,176 < 0$	1M
The equation has no real roots.	
Thus, such point R does not exist.	1A

Solution	Marks
18. (a) Required probability $= 1 - (0.2)^2$	1M
$= 0.96$	1A
(b) Required probability $= (0.8)(0.2) + (0.2)(0.8)(0.5) + (0.2)^2$	1M
$= 0.28$	1A
(c) (i) Expected salary $= 500(1 - 0.28) + 100(0.28)$	1M
$= \$388$	1A
(ii) Required probability $= (1 - 0.28)C_3^5(0.95)^3(0.05)^2 + (0.28)C_4^5(0.95)^4(0.05)$	1M
≈ 0.0724	1A
(iii) Required probability $= \dfrac{(0.28)C_4^5(0.95)^4(0.05)}{(1 - 0.28)C_3^5(0.95)^3(0.05)^2 + (0.28)C_4^5(0.95)^4(0.05)}$	1M
≈ 0.787	1A
19. (a) (i) $17^2 = 23^2 + 10^2 - 2(23)(10)\cos\angle CAB$	1M
$\angle CAB \approx 42.3^\circ$	1A
(ii) $\dfrac{AF}{\sin(180^\circ - 58^\circ - \angle CAB)} = \dfrac{10}{\sin 58^\circ}$	1M
$AF \approx 11.6\text{ cm}$	1A
(b) (i) $BF = 23 - AF \approx 11.4\text{ cm}$	
$AB^2 = AF^2 + BF^2 - 2(AF)(BF)\cos 75^\circ$	1M
$AB \approx 14.0\text{ cm}$	1A
(ii) $AP = AF\cos\angle FAC \approx 8.57\text{ cm}$	1M
$17^2 = 10^2 + (AB)^2 - 2(10)(AB)\cos\angle BAC$	
$\angle BAC \approx 88.6^\circ$	
$BP^2 = AP^2 + AB^2 - 2(AP)(AB)\cos\angle BAC$	
$BP \approx 16.2\text{ cm}$	1M
$AB^2 = AP^2 + BP^2 - 2(AP)(BP)\cos\angle APB$	
$\angle APB \approx 59.6^\circ \neq 90^\circ$	
The claim is disagreed.	1A

END OF PAPER