Solution	Marks
REG-2425-MOCK-SET 9-MATH-CP 1	
Suggested solutions	
1. $\dfrac{ab^7}{(a^3b^{-4})^{-2}} = \dfrac{ab^7}{a^{-6}b^8}$	1M
$= \dfrac{a^{1+6}}{b^{8-7}}$	1M
$= \dfrac{a^7}{b}$	1A
2. (a) $x^2 - 10xy + 25y^2 = (x-5y)^2$	1A
(b) $x^2 - 10xy + 25y^2 - 2x^2y + 10xy^2$	
$= (x-5y)^2 - 2xy(x-5y)$	1M
$= (x-5y)(x-5y-2xy)$	1A
3. We have $y+z = 5:1$ and $x+y+z = 15:20:4$.	1M
Let $x = 15k$, $y = 20k$ and $z = 4k$, where k is a non-zero number.	
$\dfrac{2x+3y}{2y-z} = \dfrac{2(15k)+3(20k)}{2(20k)-4k}$	1M
$= \dfrac{5}{2}$	1A
4. $\dfrac{9}{n+5+9} = \dfrac{3}{8}$	1M+1A
$72 = 3n + 42$	
$n = 10$	1A
5. (a) Let \$$x$ be the cost.	
$x(1+30\%) = 4940$	1M
$x = 3800$	1A
(b) Selling price	
$= 4940 \times (1-20\%)$	1M
$= \$3952$	
$> \$3800$	
The claim is agreed.	1A

Solution	Marks
6. (a) $\dfrac{4x-5}{2} > 3x+2$	
$-x > \dfrac{9}{2}$	1M
$x < -\dfrac{9}{2}$	1A
$1-2x \geq 13$	
$x \leq -6$	
Thus, we have $x < -\dfrac{9}{2}$.	1A
(b) -5	1A
7. (a) $\angle POQ = 215° - 125° = 90°$	1A
(b) $r^2 + 24^2 = 26^2$	1M
$r = 10$ or -10 (rejected)	1A
(c) Required area $= \dfrac{(24)(10)}{2}$	1M
$= 120$	1A
8. (a) Let $z = ax^2 + \dfrac{b}{\sqrt{y}}$, where a and b are non-zero constants.	1A
$\begin{cases} 5 = a + b \\ 4 = a + \dfrac{b}{\sqrt{4}} \end{cases}$	1M
Solving, we have $a = 3$ and $b = 2$.	1A
Thus, $z = 3x^2 + \dfrac{2}{\sqrt{y}}$.	
(b) New value of z	
$= 3(2)^2 + \dfrac{2}{\sqrt{1}}$	1M
$= 14$	
Increase in the value of z	
$= 14 - 4$	
$= 10$	1A

Solution	Marks
9. (a) $\angle ADC + \angle ABC = 180°$	1M
$\angle ADC = 180° - \theta$	
$\angle ACD = 90°$	1M
$\angle CAD + \angle ADC + \angle ACD = 180°$	
$\angle CAD + (180° - \theta) + 90° = 180°$	
$\angle CAD = \theta - 90°$	1A
(b) $\angle AEO = 90°$	1M
$\angle BOD = \angle CAD + \angle AEO$	
$= (\theta - 90°) + 90°$	
$= \theta$	1A
10. (a) $\angle BAC = \angle DAE$ (common $\angle$)	
$BD = BE$ (given)	
$\angle ADE = \angle BED$ (base $\angle$s, isos. $\triangle$)	
$\angle ABC = \angle BED$ (given)	
$= \angle ADE$	
$\triangle ABC \sim \triangle ADE$ (AA)	

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

Solution	Marks
(b) $\dfrac{DE}{BC} = \dfrac{AE}{AC}$	1M
$\dfrac{DE}{4} = \dfrac{2AC}{AC}$	
$DE = 8$ cm	
$\angle AED = \angle ACB = 90°$	
Consider the area of $\triangle ADE$.	
$\dfrac{1}{2} \times AE \times 8 = 24$	
$AE = 6$ cm	
$AD = \sqrt{6^2 + 8^2}$	1M
$= 10$ cm	
AD is a diameter of the circle ADE.	1M
Required area $= \pi \left(\dfrac{10}{2}\right)^2$	
$= 25\pi$ cm^2	1A

Solution	Marks
11. (a) $2 \times \frac{1}{2} \times \frac{4}{3}\pi r^3 = \frac{1}{3}\pi r^2 h$	1M
$h = 4r$	1A
(b) Volume of the liquid	
$= \frac{1}{2} \times \frac{4}{3}\pi (2)^3$	1M
$= \frac{16\pi}{3}$ cm^3	
Volume of the cone	
$= \frac{1}{3}\pi (2)^2 (4 \times 2)$	1M
$= \frac{32\pi}{3}$ cm^3	
Let h cm be the depth of liquid in the cone.	
$\frac{16\pi}{3} \div \frac{32\pi}{3} = \left(\frac{h}{8}\right)^3$	1M
$h^3 = 256$	
$h = \sqrt[3]{256}$	
≈ 6.35	
The depth of the liquid in the cone is 6.35 cm.	1A
12. (a) Let $f(x) = (x^2 - 4)Q(x) + kx + 64$, where $Q(x)$ is a polynomial.	1M
$f(2) = 0$	
$(4 - 4)Q(2) + 2k + 64 = 0$	
$k = -32$	1A
We have $f(-2) = 0 + 64 + 64 = 128$.	
$(-2)(-6 + 5)^2 - 2p + q = 128$	1M
$-2p + q = 130$	
We have $f(2) = 0$.	
$2(6 + 5)^2 + 2p + q = 0$	
$2p + q = -242$	
Solving, we have $p = -93$ and $q = -56$.	1A
(b) $f(x) = 0$	
$x(3x + 5)^2 - 93x - 56 = 0$	
$9x^3 + 30x^2 - 68x - 56 = 0$	1M
$(x - 2)(9x^2 + 48x + 28) = 0$	1M
$(x - 2)(3x + 2)(3x + 14) = 0$	
$x = 2$ or $-\frac{2}{3}$ or $-\frac{14}{3}$	
The equation $f(x) = 0$ has 3 rational roots.	1A

Solution	Marks
13. (a) The mode is 9. We have $x > 10$.	
The median is 9.5.	
$7 + 9 + x = 10 + y + 8$	1M
$y = x - 2$	
We have $(x,\ y) = (11,\ 9)$ or $(12,\ 10)$.	1A+1A
(b) When $x = 11$ and $y = 9$, standard deviation ≈ 1.61.	1M
When $x = 12$ and $y = 10$, standard deviation ≈ 1.59.	
The least possible standard deviation is 1.59.	1A
(c) The ages of the four leaving members are 7, 7, 7 and 9.	1M
When $x = 11$ and $y = 9$, mean $= \dfrac{7(4) + 8(9) + \ldots + 12(8)}{4 + 9 + \ldots + 8} = 9.7$.	
When $x = 12$ and $y = 10$, mean $= \dfrac{7(4) + 8(9) + \ldots + 12(8)}{4 + 9 + \ldots + 8} \approx 9.71$.	
The greatest possible mean is 9.71.	1A

Solution	Marks
14. (a) Let $(h,\ k)$ be the coordinates of A.	
$\begin{cases} \dfrac{k-0}{h-0} = \dfrac{3}{4} \\ 4h + 3k - 50 = 0 \end{cases}$	1M
Solving, we have $h = 8$ and $k = 6$.	1A
Required equation is	
$(x-8)^2 + (y-6)^2 = (0-8)^2 + (0-6)^2$	
$(x-8)^2 + (y-6)^2 = 100$	1A
(b) (i) $(x-8)^2 + (0-6)^2 = 100$	1M
$x^2 - 16x = 0$	
$x = 0$ or 16	
The coordinates of B are $(16,\ 0)$.	1A
(ii) Let θ be the inclination of BD.	
$\tan\theta = \dfrac{3}{4}$	
$\theta \approx 36.9°$	
$\angle OAD = 2\angle OBD$	1M
$= 2\theta$	
$\approx 73.7°$	1A
(iii) $\angle ADM = \angle OAD \approx 73.7°$	
Required area	
$= \dfrac{1}{2}(DM)(AM)$	
$= \dfrac{1}{2}(AD\cos\angle ADM)(AD\sin\angle ADM)$	1M
≈ 13.4	
< 14	
The claim is not correct.	1A
15. (a) Required probability $= \dfrac{C_4^5 C_1^7 + C_5^5}{C_5^{12}}$	1M
$= \dfrac{1}{22}$	1A
(b) Required probability $= 1 - \dfrac{C_3^5 C_2^7}{C_5^{12}} - \dfrac{1}{22}$	1M
$= \dfrac{91}{132}$	1A

Solution	Marks
16. (a) Let the mean and standard deviation of the distribution be μ and σ respectively.	
$\begin{cases} \dfrac{60-\mu}{\sigma} = 1.25 \\ \dfrac{44-\mu}{\sigma} = 0.25 \end{cases}$	1M
Solving, we have $\mu = 40$ and $\sigma = 16$.	1A+1A
(b) New standard score of Carol $= \dfrac{44(1+10\%) - 40(1+10\%)}{16(1+10\%)}$	1M
$= 0.25$	
The claim is not correct.	1A
17. (a) Let a and r be the first term and the common ratio respectively.	
$\begin{cases} \dfrac{a(1-r^3)}{1-r} = 7320 \\ \dfrac{a}{1-r} = 15\,000 \end{cases}$	1M
$15\,000(1-r^3) = 7320$	1M
$r^3 = 0.512$	
$r = 0.8$	
First term $= 15\,000(1-r) = 3000$	1A
(b) $3000(0.8)^n - 3000(0.8)^{2n} > 200$	
$15(0.8^n)^2 - 15(0.8^n) + 1 < 0$	
$0.0718 < 0.8^n < 0.928$	1M
$\log 0.0718 < n \log 0.8 < \log 0.928$	1M
$11.8 > n > 0.334$	
The greatest value of n is 11.	1A
18. (a) $f(x) = ax^2 + 8a^2x + 16a^3 + a$	
$= a(x^2 + 8ax + 16a^2) + a$	1M
$= a(x+4a)^2 + a$	1M
The coordinates of vertex are $(-4a,\ a)$.	1A
(b) (i) The graph of $y = f(x)$ is first translated rightwards by $5a$ units,	1A
then is enlarged along the y-axis to 4 times the original.	1A
(ii) $(a,\ 4a)$	1A
(iii) Slope of $OP \times$ slope of $OQ = \dfrac{a}{-4a} \times \dfrac{4a}{a} = -1$	
So, $OP \perp OQ$.	1M
Thus, the orthocentre of $\triangle OPQ$ is at O.	
The coordinates of orthocentre are $(0,\ 0)$.	1A

Solution	Marks
19. (a) $AC^2 = 11^2 + 24^2 - 2(11)(24)\cos 120°$	1M
$AC = 31$ cm	1A
$\dfrac{\sin \angle CAB}{24} = \dfrac{\sin 120°}{31}$	1M
$\angle CAB \approx 42.1°$	1A
(b) (i) Let E be a point on AB produced such that $CE \perp AB$.	
$CE = AC \sin \angle CAB \approx 20.8$ cm	1M
Required distance $= CE \sin 40°$	1M
≈ 13.4 cm	1A
(ii) Let F be the projection of C on the horizontal ground.	
$AF = \sqrt{31^2 - CF^2} \approx 28.0$ cm	
$AE = 31 \cos \angle CAB = 23$ cm	
$\cos \angle EAF = \dfrac{AE}{AF}$	1M
$\angle EAF \approx 34.7°$	
$\angle BAD = 2\angle EAF \approx 69.4°$	
Required volume	
$= \dfrac{1}{3}\left[\dfrac{1}{2} \times AB \times AD \times \sin \angle BAD\right] CF$	1M
≈ 252 cm^3	1A
(iii) Area of $\triangle ABC$	
$= \dfrac{1}{2} \times 11 \times 24 \times \sin 120°$	
$= 66\sqrt{3}$ cm^2	
Let G be the projection of D on the plane ABC.	
Consider the volume of the tetrahedron $ABDC$.	
volume $= \dfrac{1}{3}(66\sqrt{3})(DG)$	
$DG \approx 6.62$ cm	
Let θ be the required angle.	
$\sin \theta = \dfrac{DG}{CD}$	1M
$\theta \approx 16.0°$	
$> 15°$	
The claim is disagreed.	1A

END OF PAPER