COMPLETE SOLUTION

AND

MARKING SCHEME

Authored by Anson L. M. H

Secondary Three Mathematics — Mock-Test (October 2018)

Section A - Multiple Choices (24 marks, 2 marks each)

For each of the following questions, please write down the corresponding alphabet (A, B, C or D) of your answer on P.2.

1.	D	
2.	A	
3.	B	
4.	C	
5.	B	
*6.	B	(Canceled)
7.	D	
8.	A	
9.	C	
10.	B	
11.	D	
12.	C	

— The End of Section A —

Full Explanation to the Solutions of Section A.

1. $$\frac{3ab}{2b+1} = 1 - \frac{2a-3b}{b} \implies \frac{3ab}{2b+1} = \frac{b-2a+3b}{b}$$
$$\implies 3ab^2 = 8b^2 + 4b - 4ab - 2a$$
$$\implies a\left(3b^2 + 4b + 2\right) = 4b(2b+1)$$
$$\implies a = \frac{4b(2b+1)}{3b^2+4b+2}$$

2. $$\begin{aligned} 8x^2 - 6y^2 + 8xy + 2y - 4x &= \left(8x^2 + 8xy - 6y^2\right) + 2(y - 2x) \\ &= \left(8x^2 + 8xy - 6y^2\right) + 2(y - 2x) \\ &= (2x - y)(4x + 6y) - 2(2x - y) \\ &= (2x - y)(4x + 6y - 2) \\ &= 2(2x - y)(2x + 3y - 1) \end{aligned}$$

3. If $m = 2, n = 9$ and $p = 3$, then
$$\begin{aligned} m\sqrt{n^p} + \frac{\left(pm^{n-p} - mn^m\right)^m}{5m^2p^2} &= 2\sqrt{9^3} + \frac{\left(3 \times 2^{9-3} - 2 \times 9^2\right)^2}{5 \times 2^2 \times 3^2} \\ &= 2\sqrt{729} + \frac{\left(3 \times 2^6 - 2 \times 81\right)^2}{5 \times 4 \times 9} \\ &= 2(27) + \frac{(192 - 162)^2}{180} \\ &= 54 + \frac{(30)^2}{180} \\ &= 59 \end{aligned}$$

4. $$\frac{27a^3 - 2}{3a(3a+b) + b^2} + \frac{b^3(a-2) - 2a + 4}{(2-a)(9a^2 + 3ab + b^2)}$$
$$= \frac{27a^3 - 2}{9a^2 + 3ab + b^2} + \frac{b^3(a-2) - 2(a-2)}{(2-a)(9a^2 + 3ab + b^2)}$$
$$= \frac{27a^3 - 2}{9a^2 + 3ab + b^2} - \frac{\left(a-2\right)(b^3 - 2)}{(a-2)(9a^2 + 3ab + b^2)}$$
$$= \frac{(3a)^3 - b^3}{9a^2 + 3ab + b^2}$$
$$= \frac{(3a - b)\left(9a^2 + 3ab + b^2\right)}{9a^2 + 3ab + b^2}$$
$$= 3a - b$$

5. $A(2x-3)^2+B(x+2)(x-2)+C\equiv 2x^2+3(B-2A)x+A-C$

$\Longrightarrow A\left(4x^2-12x+9\right)+B(x^2-4)+C\equiv 2x^2+3(B-2A)x+A-C$

$\Longrightarrow (4A+B)x^2-12Ax+9A-4B+C\equiv 2x^2+(3B-6A)x+A-C$

By comparing the coefficients on both sides, we have

$$\Longrightarrow \begin{cases} 4A+B=2 \ \ -(\text{Eq 1.}) \\ -12A=3B-6A \ \ -(\text{Eq 2.}) \\ 9A-4B+C=A-C \ \ -(\text{Eq 3.}) \end{cases}$$

(Eq 1.) & (Eq 2.) implies $A=1$ and $B=-2$.

Substitute $A=1$ and $B=-2$ into (Eq 3.), we then obtain $C=-8$.

Hence, $\frac{A}{B}-\frac{B}{C}=\frac{1}{-2}-\frac{-2}{-8}=-\frac{1}{2}-\frac{1}{4}=-\frac{3}{4}$

6. (1) is correct: $a>b$ and $b>c$ implies $a>c$, then multiply -1 on both sides. We have $-a<-c$.

(2) is incorrect: From (1), we have proven that $a>c$. Consider the case that $a=0$, $c=-1$ $a^2=0$, $c^2=1$. Obviously in this case, $a^2<c^2$.

(3) is correct: From (1), we have proven that $a>c$. Consider taking inverse of each side, we have $\frac{1}{a}<\frac{1}{c}$.

7. (1) is correct: If $a<0$ and $b>0$, we have $a<b$. Then multiply -1 on both sides. We have $-a>-b$.

(2) is correct: $a<0$ means a is a negative number. $b>0$ means b is a positive number. The product of a negative and a positive number must be negative i.e. <0.

(3) is correct: If $a<0$ and $b>0$, we have $a<b$. Subtract b by a, we have

$$b-a>0 \Longrightarrow \frac{1}{b-a}>0$$

8. $\frac{-2x+5}{x+2}>3 \Longrightarrow -2x+5>3x+6$

$\Longrightarrow -5x>1$

$\Longrightarrow x<-\frac{1}{5}$

9. Set up the corresponding inequality: $\frac{3h(x+y)}{2}\le 120$

$\Longrightarrow h(x+y)\le 80$

$\Longrightarrow x+y\le \frac{80}{h}$

$\Longrightarrow x\le \frac{80-hy}{h}$

$\Longrightarrow \frac{1}{x}\ge \frac{h}{80-hy}$

10. For simple interest,

Amount $= P + Pnr\,\%$. Put Amount = \$79200, P = \$36000 . We have

$\$79200 = \$36000 + \$36000 \times 8 \times \frac{r}{100}$

$\Longrightarrow r = 15$

11. The value of the rare crystal at the end of 2018 $= \$300000 \times (1 + 7\%) = \$321000$

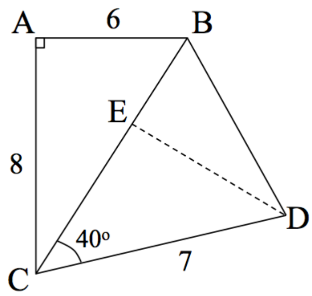
The value of the rare crystal at the end of 2019 $= \$321000 \times (1 + 10\%) = \$353100$

The value of the rare crystal at the end of 2020 $= \$353100 \times (1 + 13\%) = \$399003$

The value of the rare crystal at the end of 2021 $= \$399003 \times (1 + 16\%) = \$462843.48 = \$462843$

12. By Pythagoras's Theorem, we have $BC^2 = AB^2 + AC^2$

$\Longrightarrow BC = \sqrt{6^2 + 8^2} = 10$ units



Draw an attitude of BC through D, denotes the intersect point on BC by E.

We have $CE = 7\cos 40°$

$\Longrightarrow BE = BC - CE = 10 - 7\cos 40°$

And, $ED = 7\sin 40°$

Hence, by Pythagoras's Theorem, we have

$BD = \sqrt{ED^2 + BE^2} = \sqrt{(7\sin 40°)^2 + (10 - 7\cos 40°)^2}$

$\Longrightarrow BD \approx 6.46$ units

Section B - Short Questions (31 marks)

1. Solution

$$\frac{(x^2y^{-3})^{-2}z}{x^{-2}(z^{-1}y)^3} = \frac{x^{-4}y^6z}{x^{-2}z^{-3}y^3} \qquad \text{(1M)}$$

$$= x^{-4-(-2)}y^{6-3}z^{1-(-3)} \qquad \text{(1M)}$$

$$= x^{-2}y^3z^4$$

$$= \frac{y^3z^4}{x^2} \qquad \text{(1A)}$$

2. Solution

$$\text{LHS} = \frac{1}{2(1-\tan\theta)} - \frac{1}{2(1+\tan\theta)}$$

$$= \frac{1+\tan\theta-(1-\tan\theta)}{2(1-\tan\theta)(1+\tan\theta)}$$

$$= \frac{2\tan\theta}{2(1-\tan^2\theta)} \qquad \text{(1M)}$$

$$= \frac{\sin\theta}{\cos\theta}\cdot\frac{1}{1-\frac{\sin^2\theta}{\cos^2\theta}}$$

$$= \frac{\sin\theta}{\cos\theta}\cdot\frac{\cos^2\theta}{\cos^2\theta-\sin^2\theta}$$

$$= \frac{\sin\theta\cos\theta}{1-\sin^2\theta-\sin^2\theta} \qquad \text{(1M)}$$

$$= \frac{\sin\theta\cos\theta}{1-2\sin^2\theta}$$

$$= \text{RHS} \qquad \text{(1A)}$$

3. Solution

(a) $2x^2 + 3x - 14 = (x - 2)(2x + 7)$

(b)
$$\begin{aligned} 2(x^2-2)^2 + 3(x^2-2) - x^2 - 10 &= \left[2(x^2-2)^2 + 3(x^2-2) - 14\right] - x^2 - 10 + 14 \\ &= \left[(x^2-2) - 2\right]\left[2(x^2-2) + 7\right] - (x^2 - 4) && \text{(1M)} \\ &= (x^2-4)(2x^2+3) - (x^2-4) \\ &= (x^2-4)(2x^2+2) && \text{(1M)} \\ &= 2(x+2)(x-2)(x^2+1) && \text{(1A)} \end{aligned}$$

Alternative Method

$$\begin{aligned} 2(x^2-2)^2 + 3(x^2-2) - x^2 - 10 &= 2x^4 - 8x^2 + 8 + 3x^2 - 6 - x^2 - 10 && \text{(1M)} \\ &= 2x^4 - 6x^2 - 8 \\ &= 2\left(x^2\right)^2 - 6x^2 - 8 \\ &= (2x^2+2)(x^2-4) && \text{(1M)} \\ &= 2(x+2)(x-2)(x^2+1) && \text{(1A)} \end{aligned}$$

4. Solution

(a) $\frac{4}{3}(2x - 7) \le \frac{-1}{5}x + \frac{13}{4}$ and $x \ge 0$

$\Longrightarrow 80(2x - 7) \le -12x + 195$ and $x \ge 0$

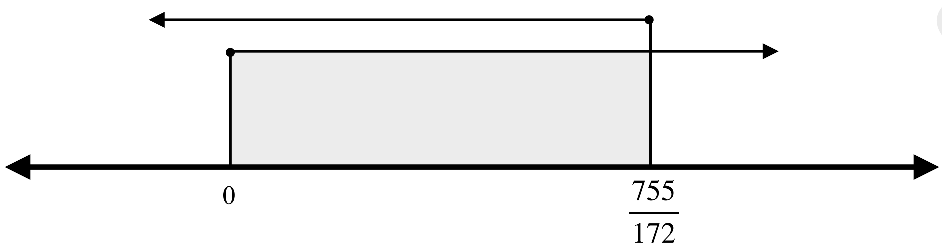
$\Longrightarrow 172x \le 755$ and $x \ge 0$

$\Longrightarrow x \le \frac{755}{172}$ and $x \ge 0$ (1A)

$\Longrightarrow 0 \le x \le \frac{755}{172}$ (OR $0 \le x < 4.39$ correct to 3 sig. fig.) (1A)

(1A for Correct Graphical Solution)

(b) 0 , 1 , 2 , 3 , 4 . (1A)



5. Solution

$$4^p = 32^{2q} = 256^{3r} \implies 2^{2p} = 2^{5(2q)} = 2^{8(3r)} \quad \text{(1M)}$$

$$\implies 2p = 10q = 24r$$

$$\implies 2p = 10q \ \ \& \ \ 10q = 24r \quad \text{(1M)}$$

$$\implies p : q = 5 : 1 \ \ \& \ \ q : r = 12 : 5$$

$$\implies p : q : r = 60 : 12 : 5 \quad \text{(1A)}$$

Therefore, $\dfrac{25q^2}{r(p-2r)} = \dfrac{25 \times 12^2}{(5)(60 - 2 \times 5)}$

$$= \frac{72}{5} \quad \text{(OR } 14.4\text{)} \quad \text{(1A)}$$

6. Solution

(a)

$$\frac{u^4 - 16}{u^2 + 4} - 2u(u-2) = \frac{u^4 - 2^4}{u^2 + 2^2} - 2u(u-2)$$

$$= \frac{\left(u^2\right)^2 - \left(2^2\right)^2}{u^2 + 2^2} - 2u(u-2)$$

$$= \frac{\left(u^2 + 2^2\right)\left(u^2 - 2^2\right)}{u^2 + 2^2} - 2u(u-2) \quad \text{(1M)}$$

$$= \left(u^2 - 2^2\right) - 2u(u-2)$$

$$= (u+2)(u-2) - 2u(u-2) \quad \text{(1M)}$$

$$= (u-2)(u+2-2u)$$

$$= (u-2)(2-u)$$

$$= -(u-2)^2 \quad \text{(1A)}$$

(b)

$$2u(u-2) - \frac{u^4 - 16}{u^2 + 4} = 36 \implies \frac{u^4 - 16}{u^2 + 4} - 2u(u-2) = -36$$

$$\implies -(u-2)^2 = -36 \quad \text{(1M for Using Part a)}$$

$$\implies (u-2)^2 = 36$$

$$\implies (u-2) = 6 \ \text{ or } \ (u-2) = -6$$

$$\implies u = 8 \ \text{ or } \ u = -4 \quad \text{(1A)}$$

7. Solution

Cost $= 840 \times \$2.4 = \$2016$ (1A for Both Correct)

Income $= 840 \times (1 - 22.5\%) \times \$x = \$651x$

Profit Percentage $\geq 36\%$

$$\Longrightarrow \frac{\$651x - \$2016}{\$2016} \geq 36\%$$ (1M)

$\Longrightarrow x \geq 4.21$ (correct to 3 sig. fig.)

So, the minimum value of $x = 4.21$. (1A)

8. Solution

(a) Interest obtained from simple interest $= Pnr\% = \dfrac{Pnr}{100}$. (1A)

Interest obtained from compound interest $= P\left(1 + \dfrac{r\%}{12}\right)^{12n} - P$ (1A)

$$= P\left[\left(1 + \frac{r}{1200}\right)^{12n} - 1\right]$$

So, the required different $= P\left[\left(1 + \dfrac{r}{1200}\right)^{12n} - 1\right] - \dfrac{Pnr}{100}$

$$= P\left[\left(1 + \frac{r}{1200}\right)^{12n} - \frac{nr}{100} - 1\right]$$ (1A)

(b) Substitute $n = 5$, $r = 12$ in the equation obtained from part a), we have

$\$1560.21623 = P(1.01^{60} - 0.6 - 1)$ (1M)

$\Longrightarrow P = \$7200$ (1A)

Section C - Long Questions (45 marks)

1. Solution

(a) $AE = EC = \dfrac{a}{2}$ cm

$\angle HEF = \angle CED$ (common)

$\angle EHF = \angle ECD = 90°$

$\angle EFH = \angle EDC$ (corr. $\angle s$ $HG // CD$)

Therefore, $\triangle EFH \sim \triangle EDC$ (AAA)

Consider $\dfrac{EH}{EC} = \dfrac{HF}{CD} \implies \dfrac{EC - HC}{EC} = \dfrac{CD - FG}{CD}$

$$\implies \frac{\frac{a}{2} - GD}{\frac{a}{2}} = \frac{a - FG}{a} \qquad \text{(1M)}$$

$$\implies a - 2GD = a - FG$$

$$\implies GD = \frac{FG}{2} \qquad \text{(1A)}$$

In $\triangle FGD$, by Pythagoras's Theorem, we have $FG^2 + GD^2 = FD^2$, substitute $GD = \dfrac{FG}{2}$,

$$\implies FG^2 + \left(\frac{FG}{2}\right)^2 = FD^2 \qquad \text{(1M)}$$

$$\implies \frac{5FG^2}{4} = FD^2$$

$$\implies FG = \frac{2FD}{\sqrt{5}} \qquad \text{(1A)}$$

(b) Consider $\triangle FGD$, by Pythagoras's Theorem, we have $FG^2 + GB^2 = BF^2$, from part a), we have $FG = \dfrac{2FD}{\sqrt{5}}$. Then, we obtain

$$\left(\frac{2FD}{\sqrt{5}}\right)^2 + GB^2 = BF^2 \implies \frac{4FD^2}{5} + GB^2 = BF^2 \text{ Divide both sides by } GB^2 \qquad \text{(1M)}$$

$$\implies \frac{4}{5} \cdot \left(\frac{FD}{GB}\right)^2 + 1 = \left(\frac{BF}{FG}\right)^2$$

$$\implies \left(\frac{BF}{FG}\right)^2 = \frac{4}{5} \cdot \left(\frac{5}{4}\right)^2 + 1 \qquad \text{(1M)}$$

$$\implies \left(\frac{BF}{FG}\right)^2 = \frac{9}{4} \qquad \text{(1A)}$$

2. <u>Solution</u>

(a) $x^2+\frac{1}{x^2}=\left(x^2+2\cdot x\cdot\frac{1}{x}+\frac{1}{x^2}\right)-2$

$=\left(x+\frac{1}{x}\right)^2-2$ (1M)

$=m^2-2$ (1A)

(b) Firstly, $x-\frac{1}{x}=\sqrt{\left(x-\frac{1}{x}\right)^2}$ (1M Either One)

$=\sqrt{x^2-2\cdot x\cdot\frac{1}{x}+\frac{1}{x^2}}$

$=\sqrt{x^2+\frac{1}{x^2}-2}$

$=\sqrt{m^2-4}$

$=\sqrt{(m+2)(m-2)}$ (1A)

Then, $x^3-\frac{1}{x^3}=\left(x-\frac{1}{x}\right)\left(x^2+1+\frac{1}{x^2}\right)$ (1M Either One)

$=(m^2-1)\sqrt{(m+2)(m-2)}$

$=(m+1)(m-1)\sqrt{(m+2)(m-2)}$ (1A)

3. Solution

(a)(i) Arc $AB = 2\pi r \dfrac{80^\circ}{360^\circ} = \dfrac{4\pi r}{9}$ cm

Let the radius and the height of the base of the cone be r_1 and h respectively.

Consider $2\pi r_1 = \dfrac{4\pi r}{9}$

$$r_1 = \frac{2r}{9} \text{ cm} \qquad \text{(1A)}$$

By Pythagoras Theorem, we have

$$r_1^2 + h^2 = AC^2 \implies h^2 = r^2 - r_1^2$$

$$\implies h = \sqrt{r^2 - \left(\frac{2r}{9}\right)^2}$$

$$\implies h = \sqrt{\frac{77r^2}{81}} = \frac{r}{9}\sqrt{77} \text{ cm} \qquad \text{(1A)}$$

Hence, the required volume $= \dfrac{1}{3}\pi r_1^2 h$ (1M)

$$= \frac{\pi}{3} \cdot \frac{4r^2}{81} \cdot \frac{r}{9}\sqrt{77}$$

$$= \frac{4\pi r^3\sqrt{77}}{2187} \text{ cm}^3 \qquad \text{(1A)}$$

(a)(ii) The required percentage change $= \dfrac{(0.85r)^3 - r}{r} \times 100\,\%$ (1M)

$$= -38.5875\,\% \quad (\text{OR}, -38.6\,\%) \qquad \text{(1A)}$$

(a)(iii) Let the radius of the base of the smaller cone be r_2.

By the ratio of similar triangles, we have $\dfrac{r_2}{r_1} = \dfrac{0.2r}{h}$ (1M)

$$\implies r_2 = 0.2r \cdot \frac{2r}{9} \cdot \frac{9}{r\sqrt{77}}$$

$$\implies r_2 = \frac{2r}{5\sqrt{77}} \text{ cm} \qquad \text{(1A)}$$

Volume of the smaller cone $= \dfrac{1}{3}\pi r_2^2(0.2r) = \dfrac{1}{3}\pi \dfrac{4r^2}{1925}(0.2r)$

$$= \frac{4\pi r^3}{28875} \text{ cm}^3 \qquad \text{(1A)}$$

Hence, the volume of the remaining frustum $= \dfrac{4\pi r^3\sqrt{77}}{2187} - \dfrac{4\pi r^3}{28875}$ cm³

$$= 4\pi r^3\left(\frac{\sqrt{77}}{2187} - \frac{1}{28875}\right) \text{ cm}^3 \qquad \text{(1A)}$$

4. Solution

(a)(i) Amount $= \$P\left(1+\frac{10\,\%}{2}\right)^2 = \$1.05^2P$ (1A)

(a)(ii) Amount $= \$1.05^2P\left(1+\frac{10\,\%}{2}\right)^2 + \$(1+25\%)P\left(1+\frac{10\,\%}{2}\right)^2$ (1M)

$= \$\left(1.05^4P + 1.25\cdot 1.05^2P\right)$ (1A)

(a)(iii) Amount $= \$\left[1.05^4P + 1.25\cdot 1.05^2P + 1.25P\cdot(1+25\%)\right]\left(1+\frac{10\,\%}{2}\right)^2$ (1M)

$= \$\left(1.05^6P + 1.25\cdot 1.05^4P + \$1.25^2\cdot 1.05^2P\right)$ (1A)

(b) Amount

$= 1.05^{40}P + 1.25\cdot 1.05^{38}P + 1.25^2\cdot 1.05^{36}P + \ldots + 1.25^{18}\cdot 1.05^4P + 1.25^{19}\cdot 1.05^2P$ (1A)

$= 1.05^2P(1.05^{20} + 1.25\cdot 1.05^{19} + 1.25^2\cdot 1.05^{18} + \ldots + 1.25^{18}\cdot 1.05^2 + 1.25^{19}\cdot 1.05)$

$= 1.05^2P\cdot 1.25^{20}\left[\left(\frac{1.05}{1.25}\right)^{20} + \left(\frac{1.05}{1.25}\right)^{19} + \left(\frac{1.05}{1.25}\right)^{18} + \ldots + \left(\frac{1.05}{1.25}\right)^{2} + \left(\frac{1.05}{1.25}\right)\right]$ (1M)

$= 1.05^2P\cdot 1.25^{20}\cdot\frac{\frac{1.05}{1.25}\left(1-\frac{1.05^{20}}{1.25^{20}}\right)}{1-\frac{1.05}{1.25}}$ (using the given formula) (1M)

$= \$5.25\times 1.05^2P\left(1.25^{20} - 1.05^{20}\right)$ (1A)

(c) Consider $5.25\times 1.05^2P\left(1.25^{20}-1.05^{20}\right) \geq 2700000$ (1M)

$\implies P \geq \$5547.768165$

So, the minimum value of $P = \$5548$. (1A)

5. Solution

(a)(i) Since,

$CD = BD$ (sides of square $ABDC$)

$DE = DG$ (sides of square $EFGD$)

$\angle CDE = \angle CDB + \angle BDE = 90^\circ + \alpha$

$\angle BDG = \angle BDE + \angle EDG = 90^\circ + \alpha$

$= \angle CDE$

Therefore, $\triangle CDE \cong \triangle BDG$ (SAS)

	No or Totally Incorrect Reasons	**Incomplete or Partially Correct Reasons**	**Complete and Totally Correct Reasons**
Score(s) Awarded	0 mark	1 or 2 mark(s)	3 marks

Marking Criteria

- Zero mark will be given if candidate CANNOT prove $\triangle CDE \cong \triangle BDG$ successfully.
- 2-3 marks will be given only if the rules for proving $\triangle CDE \cong \triangle BDG$ is correct (eg. SAS).
- 1 mark will be given if no reasons are shown but candidate can demonstrate effective logical flow.
- 3 marks will be given only if complete and totally correct reasons are shown.

(a)(ii) $\angle CED = \angle BGD = \beta$ (corr. $\angle s$, $\triangle CDE \cong \triangle BDG$)

Then, $\angle ECD + \angle CDE + \angle CED = 180^\circ$ ($\angle$ sum of $\triangle$)

$\Longrightarrow \angle ECD = 180^\circ - 90^\circ - \alpha - \beta$

$= 90^\circ - (\alpha + \beta)$ (1A)

Let the length of the altitude of CE that passes through D be L. We have

$$\begin{cases} L = CD \sin\angle ECD \\ L = ED \sin\angle CED \end{cases}$$ (1M)

$$\Longrightarrow CD \sin\angle ECD = ED \sin\angle CED$$

$$\Longrightarrow \frac{CD}{\sin\angle CED} = \frac{ED}{\sin\angle ECD}$$

$$\Longrightarrow \frac{CD}{\sin\beta} = \frac{ED}{\sin\left[90^\circ - (\alpha + \beta)\right]}$$

$$\Longrightarrow \frac{CD}{\sin\beta} = \frac{ED}{\cos(\alpha + \beta)}$$ (1A)

(b)(i) $\cos 75^\circ = \cos(45^\circ + 30^\circ)$

$= \cos 45^\circ \cos 30^\circ - \sin 45^\circ \sin 30^\circ$ (1M)

$$= \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \cdot \frac{1}{2}$$

$$= \frac{\sqrt{3} - 1}{2\sqrt{2}}$$ (1A)

Solution (Continue)

(b)(ii) $\angle CDG = 165^\circ \implies \text{reflex}\angle CDG = 360^\circ - 165^\circ = 195^\circ$

$\implies \alpha = 195^\circ - 2 \times 90^\circ$

$\implies \alpha = 15^\circ$ (1A)

$\angle GBD = \angle ECD = 90^\circ - (\alpha + \beta)$ (corr. $\angle s$, $\triangle CDE \cong \triangle BDG$)

$\angle ABG = 105^\circ \implies \angle ABD + \angle GBD = 105^\circ$

$\implies 90^\circ - (\alpha + \beta) = 105^\circ - 90^\circ$

$\implies 15^\circ + \beta = 75^\circ$

$\implies \beta = 60^\circ$ (1A)

Then, consider $\dfrac{CD}{\sin\beta} = \dfrac{ED}{\cos(\alpha+\beta)}$

$$\implies \frac{CD}{ED} = \frac{\sin\beta}{\cos(\alpha+\beta)}$$

$$\implies \left(\frac{CD}{ED}\right)^2 = \left[\frac{\sin 60^\circ}{\cos(15^\circ + 60^\circ)}\right]^2 = \frac{\sin^2 60^\circ}{\cos^2 75^\circ}$$ (1M)

$$\implies \frac{\text{Area of } ABDC}{\text{Area of } EFGD} = \frac{3}{4} \cdot \frac{8}{3 - 2\sqrt{3} + 1} = \frac{3}{2-\sqrt{3}} \cdot \frac{2+\sqrt{3}}{2+\sqrt{3}}$$

$$\implies \frac{\text{Area of } ABDC}{\text{Area of } EFGD} = 3\left(2+\sqrt{3}\right)$$ (1A)

— End of Paper —