1 **(a)** Expand and simplify $\left(2a-b+\frac{c}{8}\right)^2$. [2]

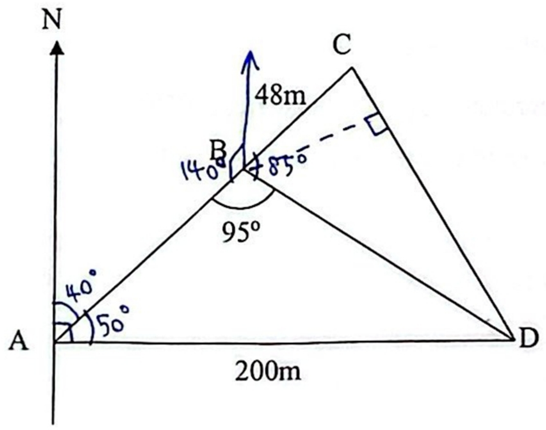
(b) Simplify $\frac{(p+2q)^2}{p^3+8q^3}\times\frac{(p^2-2pq)^2-16q^4}{p+2q}$. [3]

2 Express $\frac{5}{12x+4y}+\frac{1}{2y-3x}+\frac{3}{9x^2-3xy-2y^2}$ as a single fraction, leaving your answer in its simplest form. [3]

3 Make r the subject of the formula $3h=2p\sqrt{\frac{r+k}{r-k}}$. [3]

4 Solve $8(3p+2)^6=7(3p+2)^3+1$ by substituting $y=(3p+2)^3$. [4]

5 A, B, C and D are four points on a horizontal field where D is due east of A. $AD=200$m, $BC=48$m and angle $ABD=95°$. The bearing of B from A is 040°.



(a) Find the bearing of A from B. [1]

(b) **Show** that the length of CD is 157.07 m, correct to 5 significant figures. [4]

(c) Find the shortest distance from B to CD. [2]

A pole of height 9.5 m is located at C.

(d) Calculate the angle of depression of D from the top of the pole at C. [2]

6 Diagram I shows a figure formed using a **regular** hexagon $ABCDEF$ and three identical sectors OGH, OIJ and OKL. The hexagon has sides 6 cm and the radius of the sectors is 9 cm. The centres of the hexagon and sectors coincide at O as shown in diagram II.

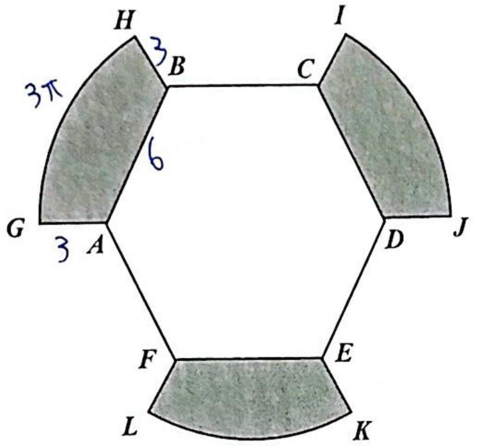


Diagram I

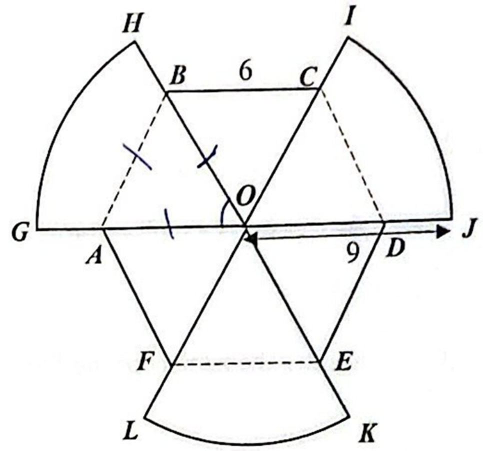


Diagram II

(a) Show that the angle AOB is $\frac{\pi}{3}$ rad. [1]

(b) Find

(i) the perimeter of the shaded area $ABHG$, [2]

(ii) the area of whole figure in Diagram I. [3]

End of Paper

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$\frac{30}{50} = 100\%$

1. (a) $(2a-b+\frac{c}{8})^2 = 4a^2+b^2+\frac{c^2}{64}-4ab+\frac{4ac}{8}-\frac{2bc}{8}$

$= 4a^2+b^2+\frac{c^2}{64}-4ab+\frac{ac}{2}-\frac{bc}{4}$

(b) $\frac{(p+2q)^4}{p^3+8q^3} \times \frac{(p^2-2pq)^2-16q^4}{p+2q}$

$= \frac{\cancel{p+2q}}{\cancel{(p+2q)}\cancel{(p^2-2pq+4q^2)}} \times \frac{\cancel{(p^2-2pq+4q^2)}(p^2-2pq-4q^2)}{1}$

$= p^2-2pq-4q^2$

5

2. $\frac{5}{12x+4y} + \frac{1}{2y-3x} + \frac{3}{9x^2-3xy-2y^2}$

$= \frac{5}{4(3x+y)} - \frac{1}{3x-2y} + \frac{3}{(3x-2y)(3x+y)}$

$= \frac{5(3x-2y)-4(3x+y)+12}{4(3x+y)(3x-2y)}$

$= \frac{15x-10y-12x-4y+12}{4(3x+y)(3x-2y)}$

$= \frac{3x-14y+12}{4(3x+y)(3x-2y)}$

3

3. $3h = 2p\sqrt{\frac{r+k}{r-k}}$

$\frac{3h}{2p} = \sqrt{\frac{r+k}{r-k}}$

$\frac{r+k}{r-k} = \frac{9h^2}{4p^2}$

$4p^2(r+k) = 9h^2(r-k)$

$4p^2r+4p^2k = 9h^2r-9h^2k$

$9h^2r-4p^2r = 9h^2k+4p^2k$

$r(9h^2-4p^2) = 9h^2k+4p^2k$

$r = \frac{9h^2k+4p^2k}{9h^2-4p^2}$

3

4. $8(3p+2)^6 = 7(3p+2)^3+1$

$8y^2 = 7y+1$

$8y^2-7y-1=0$

$(8y+1)(y-1)=0$

$y=-\frac{1}{8}$ or $y=1$

$(3p+2)^3 = -\frac{1}{8}$ or $(3p+2)^3=1$

$3p+2 = -\frac{1}{2}$ or $3p+2=1$

$3p = -\frac{5}{2}$ or $3p=-1$

$p = -\frac{5}{6}$ or $p = -\frac{1}{3}$

4

5\. (a) Bearing of A from B $= 360° - (180° - 40°)$

$= 360° - 140°$

$= 220°$

(b) $\angle BAD = 90° - 40°$

$= 50°$

$\frac{BD}{\sin 50°} = \frac{200}{\sin 95°}$

$BD = \sin 50° \times \frac{200}{\sin 95°}$

$= \frac{200 \sin 50°}{\sin 95°}$

$\angle CBD = 180° - 95°$

$= 85°$

$CD^2 = 48^2 + \left(\frac{200 \sin 50°}{\sin 95°}\right)^2 - 2(48)\left(\frac{200 \sin 50°}{\sin 95°}\right)\cos 85°$

$CD = 157.07$ m (5 s.f.)

(c) Shortest distance from B to CD

$= \left(\frac{1}{2} \times 48 \times \frac{200 \sin 50°}{\sin 95°} \times \sin 85°\right) \div \frac{1}{2} \div 157.07$

$= 46.820$

$= 46.8$ m (3 s.f.)

(d) $\measuredangle$ of depression $= \tan^{-1}\left(\frac{9.5}{157.07}\right)$

$= 3.4612$

$= 3.5°$ (1 d.p.)

9

6\. (a) $\angle AOB = \pi \div 3$

$= \frac{\pi}{3}$ rad

(b)(i) $AG = BH$

$= 9 - 6$

$= 3$

$GH = \frac{9\pi}{3} = 3\pi$

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Perimeter of ABHG $= 6+3+3+3\pi$
$= 21.425$
$= 21.4\text{cm}\ (3\text{s.f.})$

(ii) Area of whole figure
$=$ area of 3 sectors $+$ area of 3 triangles
$= 3\times\frac{1}{2}(9)^2(\frac{\pi}{3}) + 3\times\frac{1}{2}(6)(6)(\sin\frac{\pi}{3})$
$= 174.00$
$= 174\ \text{cm}^2\ (3\text{s.f.})$

6