1 Expand and simplify $(3x - y + 5)^2$. [2]

2 (a) Express as a single fraction in its simplest form $\frac{x+1}{2x^2 - 18} - \frac{4}{3-x}$ [3]

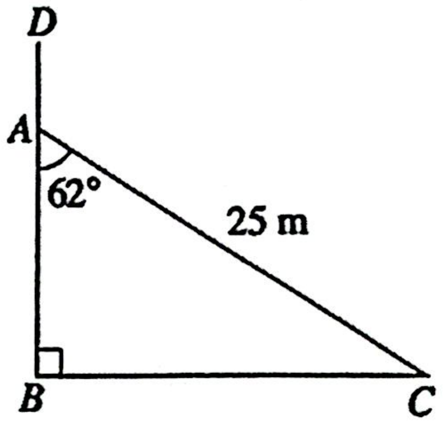
(b) Rearrange the formula $3x = \sqrt{\frac{y+3}{y-2}}$ to make y the subject. [3]

3 (a) Factorise completely $27x^3 - 125y^6$. [2]

(b) Hence, simplify $\frac{27x^3 - 125y^6}{9x^2 - 30xy^2 + 25y^4} \div \frac{(9x^2 + 15xy + 25y^2)}{9x^2 - 25y^4}$. [3]

4 Solve $2x^2 - x = (2x-1)^2$. [2]

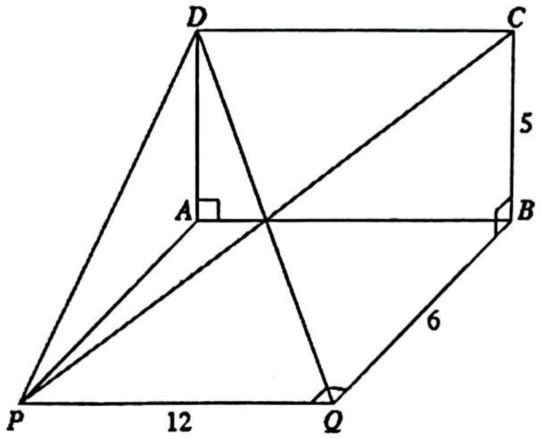
5



In the diagram, $\angle BAC = 62°$ and $AC = 25$ m. Given that $\cos 62° = 0.469$ when corrected to 3 significant figures, **without using a calculator,** find the value of $\cos \angle DAC$. [1]

6 The area of triangle ABC is 67.8 cm^2. $AB = 19.7$ cm and $BC = 13.6$ cm.
Find the two possible sizes of the angle ABC. [3]

7



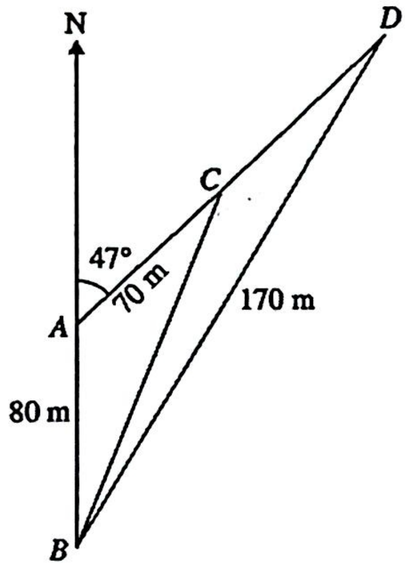
A rectangular billboard $ABCD$ is supported to stand vertically on a horizontal flat ground $ABQP$, by straight beams PQ, PD, AP, PC, QD and QB.

Given that PQ is perpendicular to QB, $BC=AD=5$ m, $QB=PA=6$ m and $PQ=AB=12$ m, find

(a) the length of PC, [2]

(b) $\cos\angle AQD$. [1]

8



The diagram shows a straight street ACD running from A in the direction 047°. B is 80m due south of A. It is given that $BD = 170$ m and $AC = 70$ m.

(a) Calculate

- **(i)** the bearing of D from B, [2]
- **(ii)** the distance of BC. [2]
- **(iii)** the shortest distance of A to the street BD. [2]

(b) Given that there is a building at D and the angle of elevation of the top of the building from B is 33°, calculate the height of the building. [2]

End of Paper

1. $(3x-y+5)^2$

$= (3x-y+5)(3x-y+5)$

$= 9x^2 - 3xy + 15x - 3xy + y^2 - 5y + 15x - 5y + 25$

$= 9x^2 - 6xy + 30x - 10y + y^2 + 25$

2

2(a). $\dfrac{x+1}{2x^2-18} - \dfrac{4}{3-x}$

$= \dfrac{x+1}{2(x^2-9)} - \dfrac{4}{3-x}$

$= \dfrac{x+1}{2(x^2-3^2)} - \dfrac{4}{3-x}$

$= \dfrac{x+1}{2(x+3)(x-3)} - \dfrac{2(4)(x+3)}{2(3-x)(x+3)}$

$= \dfrac{x+1}{2(x+3)(x-3)} - \dfrac{8(x+3)}{-2(x-3)(x+3)}$

$= \dfrac{x+1}{2(x+3)(x-3)} + \dfrac{8(x+3)}{2(x+3)(x-3)}$

$= \dfrac{x+1+8x+24}{2(x+3)(x-3)}$

3

$= \dfrac{9x+25}{2x^2-18}$

2(b). $3x = \sqrt{\dfrac{y+3}{y-2}}$

$(3x)^2 = \dfrac{y+3}{y-2}$

5

$9x^2 = \dfrac{y+3}{y-2}$

$$9x^2(y-2) = y+3$$
$$9x^2y - 18x^2 = y+3$$
$$9x^2y - y = 3 + 18x^2$$
$$y(9x^2-1) = 3 + 18x^2$$
$$y = \frac{3+18x^2}{9x^2-1}$$

3

3(a). $27x^3 - 125y^6$
$$=(3x)^3 - (5y^2)^3$$
$$= (3x-5y^2)(9x^2+15xy^2+25y^4)$$

2

3(b). $$\frac{27x^3 - 125y^6}{9x^2 - 30xy^2 + 25y^4} \div \frac{(9x^2+15xy+25y^2)}{9x^2-25y^4}$$
$$= \frac{(3x-5y^2)(9x^2+15xy^2+25y^4)}{(3x-5y^2)^2} \div \frac{(9x^2+15xy+25y^2}{(3x)^2-(5y^2)^2}$$
$$= \frac{(3x-5y^2)(9x^2+15xy^2+25y^4)}{(3x-5y^2)^2} \times \frac{(3x+5y^2)(3x-5y^2)}{(9x^2+15xy+25y^2)}$$
$$= \frac{(3x-5y^2)^2(9x^2+15xy^2+25y^4)(3x+5y^2)}{(3x-5y^2)^2(9x^2+15xy+25y^2)}$$
$$= \frac{(3x+5y^2)(9x^2+15xy^2+25y^4)}{(9x^2+15xy+25y^2)}$$

3

good

8

4. $2x^2 - x = (2x-1)^2$

$2x^2 - x = (2x)^2 - 2(2x)(1) + 1^2$

$2x^2 - x = 4x^2 - 4x + 1$

$2x^2 - 4x^2 - x + 4x - 1 = 0$

$-2x^2 + 3x - 1 = 0$

$(-2x+1)(x-1) = 0$

$-2x$	1	x
x	-1	$2x$
$-2x^2$	-1	$3x$

$-2x + 1 = 0$ or $x - 1 = 0$

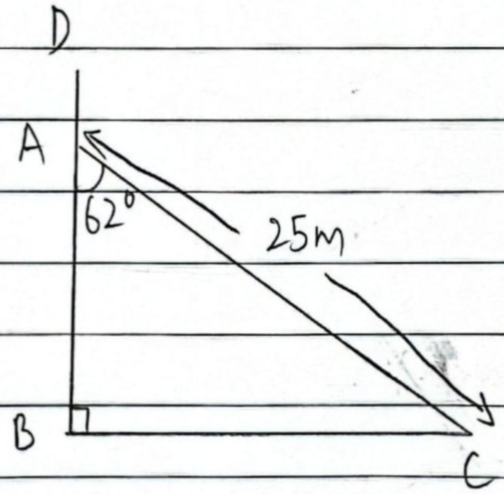
$-2x = -1$ $\quad$ $x = 1$

$-x = -\frac{1}{2}$

$x = \frac{1}{2}$

2

5.



since $\cos(\theta°) = -\cos(180 - \theta°)$,

$\cos \angle DAC = -\cos \angle BAC$

$= -\cos 62°$

$= -0.469$ (to 3s.f.)

1

6. $67.8 = \frac{1}{2}(19.7)(13.6) \sin \angle ABC$

$67.8 = 133.96 \sin \angle ABC$

5

$\angle ABC = \sin^{-1}\left(\frac{67.8}{133.96}\right)$

$= 30.41$

$= 30.4°$ (to 1d.p.)

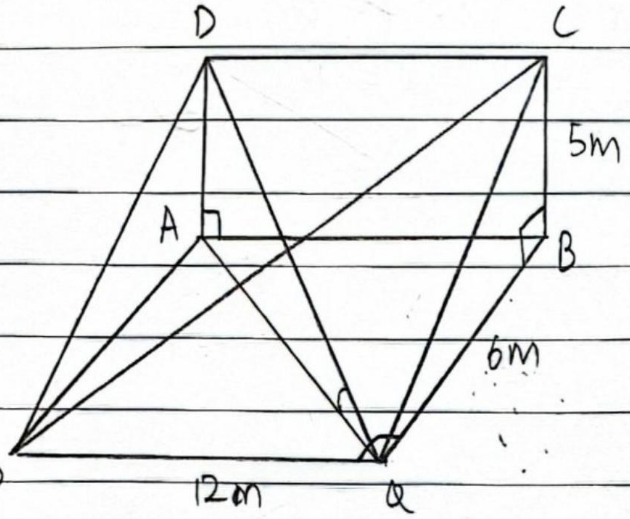
2

Since $\sin(\theta°) = \sin(180° - \theta°)$,
$180° - 30.4° = 149.6°$

1

$\therefore$ The two possible sizes of $\angle ABC$ are $30.4°$ and $149.6°$

7(a).



In $\triangle BCQ$,

$QC^2 = BQ^2 + CB^2$ (Pythagoras' Theorem)

$QC^2 = 5^2 + 6^2$

$QC = \sqrt{61}$

$QC = 7.810$

$= 7.81m$ (to 3s.f.)

In $\triangle PCQ$,

$PC^2 = PQ^2 + QC^2$ (Pythagoras' Theorem)

$PC^2 = 12^2 + 7.81^2$

$PC = \sqrt{204.9961}$

$PC = 14.32$

$= 14.3m$ (to 3s.f.) 2

3

7(b). In $\triangle APQ$,

$AQ^2 = AP^2 + PQ^2$ (Pythagoras' Theorem)

$AQ = \sqrt{12^2+6^2}$

$= 13.42$

$= 13.4m$

$DQ = PC$

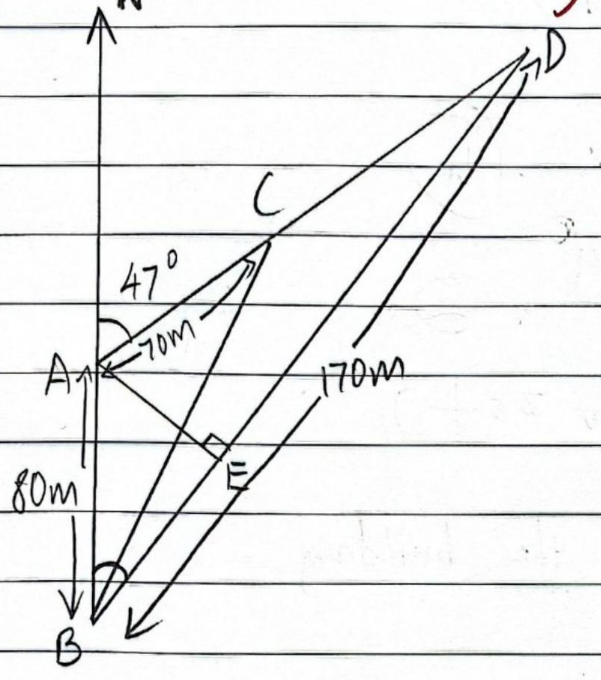
$= 14.3m$

$\therefore \cos \angle AQD = \dfrac{13.4}{14.3}$

$= 0.937$ ~~(3sf)~~

A

8(a)(i).



$\angle BAD = 180° - 47°$

$= 133°$

In $\triangle ABD$,

$\dfrac{170}{\sin 133°} = \dfrac{80}{\sin \angle ADB}$

1

$170 \sin \angle ADB = 80 \sin 133°$

$\sin \angle ADB = \dfrac{80 \sin 133°}{170}$

$\therefore \angle ADB = \sin^{-1}\left(\dfrac{80 \sin 133°}{170}\right)$

$= 20.13$

$= 20.1^\circ$ (to 1 d.p.) 1

$\therefore \angle ABD = 180^\circ - 20.1^\circ - 133^\circ$

$= 26.9^\circ$

$\therefore$ Bearing of D from B $= 026.9^\circ$

2(a)(ii). In $\triangle ABC$,

$BC^2 = 80^2 + 70^2 - 2(80)(70)\cos 133^\circ$

$BC = \sqrt{18938.38163}$

$= 137.6$

$= 138$ m (to 3 s.f.) 2

2(a)(iii). In $\triangle ABE$, 4

$\sin 26.9^\circ = \frac{AE}{80}$

$AE = 80 \sin 26.9^\circ$

$= 36.19$ 2

$= 36.2$ m (to 3 s.f.)

2(b). let h be the height of the building,

$\tan 33^\circ = \frac{h}{170}$

$h = 170 \tan 33^\circ$

$= 110.4$

$= 110$ m (to 3 s.f.)

2

7