C.E.M. TUITION

Student Name : ____________________

Review : Specimen Paper 4

(Preliminary Course)

Year 12 - 2 Unit

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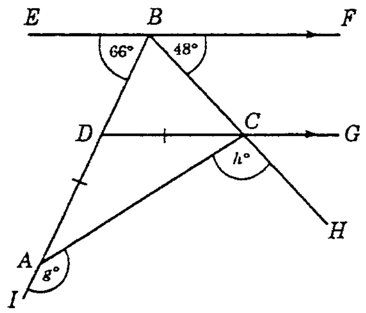
SECTION D

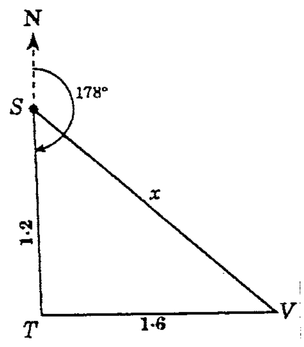
1. Two dice (each normal six-sided) are thrown and the product of the numbers uppermost calculated.
   Find the probability that the product is:
   - (a) 1
   - (b) odd
   - (c) greater than 20
   - (d) odd or greater than 20.

2. 

Given $EF \parallel DG$; IB and BH are straight lines; $AD = DC$, $\angle EBD = 66°$, $\angle FBC = 48°$.
Find the values of g and h giving adequate reasons for each step in your working.

3. Jillian, during a bush walk, walks 1·2 km on a bearing of 178° to T, then turns due East and walks a further 1·6 km to V.

   Calculate Jillian's distance from her starting point, S (correct to 2 significant figures).



4. (a) Show that the triangle whose sides satisfy $2x - y = 0$, $x + 2y = 5$ and $x - 3y = 20$ is both right-angled and isosceles.

(b) Given that the point $(4, k)$ lies on the line $y = 3x - 7$, evaluate k.

5. (a) Sketch the region where both $y \leq \sqrt{9-x^2}$ and $x-3y \leq 3$ hold simultaneously.

(b) Factor completely $x^2-3x-xy+3y$.

SECTION D

1.

X	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

36 possible outcomes

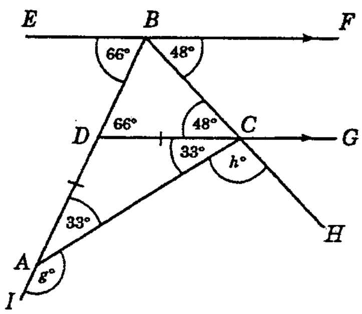
(a) $P(1) = \frac{1}{36}$.

(b) $P(\text{odd}) = \frac{9}{36} = \frac{1}{4}$.

(c) $P(>20) = \frac{6}{36} = \frac{1}{6}$.

(d) $P(\text{odd or} >20) = \frac{14}{36} = \frac{7}{18}$.

2.



$B\hat{C}D = 48°$ (alt. $\angle$s, $EF \parallel DG$)

$\angle BDC = 66°$ (alt. $\angle$s, $EF \parallel DG$)

$\angle DAC + \angle DCA = 66°$
(ext. $\angle$ of ΔDAC).

But $\angle DAC = \angle DCA$
(base $\angle$s of isosceles Δ)

$\therefore$ $\angle DAC = 33°$, $\angle DCA = 33°$.

Now, $h + 33 + 48 = 180$
(BH is a straight line)

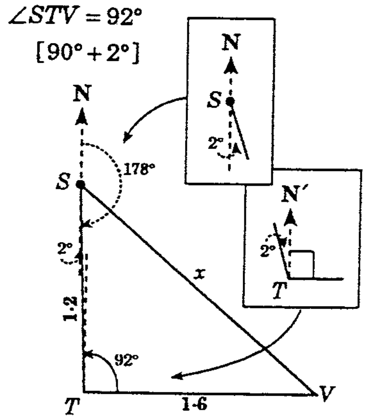
$\therefore$ $h = 99$.

Also, $g + 33 = 180$
(IB is a straight line)

$\therefore$ $g = 147$.

Then $h = 99$, $g = 147$.

3. $\angle STV = 92°$
$[90° + 2°]$



$x^2 = 1{\cdot}2^2 + 1{\cdot}6^2 - 2(1{\cdot}2)(1{\cdot}6)\cos 92°$

$= 4{\cdot}134\,014\,1$

$\therefore$ $x = \sqrt{4{\cdot}134\,014\,1}$

$= 2{\cdot}033\,227\,5$

$\approx 2{\cdot}0$.

Distance from S is $2{\cdot}0$ km.

4. (a) Consider $2x - y = 0$

$y = 2x$ —①

and $x + 2y = 5$ —②

Substitute ① into ②:

$x + 2(2x) = 5$

$5x = 5$

$x = 1$.

Sub. in ①: $y = 2$.

First vertex, call it A, is $(1, 2)$.

Now take $y = 2x$ —①

with $x - 3y = 20$ —③

Substitute ① into ③:

$x - 3(2x) = 20$

$x - 6x = 20$

$-5x = 20$

$x = -4$.

Sub. in ①: $y = -8$.

Second vertex, call it B, is $(-4, -8)$.

Now take $x + 2y = 5$ —②

$x - 3y = 20$ —③

② − ③ $5y = -15$

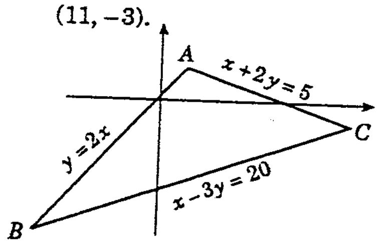
$y = -3$

Sub. into ②:

$x - 6 = 5$

$x = 11$.

Third vertex, call it C, is $(11, -3)$.



Consider eqns.

$2x - y = 0$, i.e. $y = 2x$

$m_1 = 2$,

and $x + 2y = 5$

$2y = -x - 5$

$y = -\frac{1}{2}x - 5$

$m_2 = -\frac{1}{2}$.

Then as $m_1 \times m_2 = 2 \times -\frac{1}{2} = -1$,

lines are perpendicular,

$\therefore$ right angle at A.

$A(1, 2)$

$B(-4, -8)$

$C(11, -3)$

$AB = \sqrt{(1 - -4)^2 + (2 - -8)^2}$

$= \sqrt{5^2 + 10^2}$

$= \sqrt{125} = 5\sqrt{5}$.

$AC = \sqrt{(1 - 11)^2 + (2 - -3)^2}$

$= \sqrt{(-10)^2 + 5^2}$

$= \sqrt{125} = 5\sqrt{5}$,

$\therefore$ $AB = AC$.

Triangle is isosceles ($AB = AC$) and is right angled at A.

(b) $(4, k)$ in $y = 3x - 7$,

$k = 3(4) - 7$

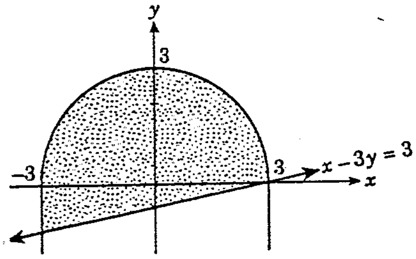
$= 12 - 7$

$= 5$

$\therefore$ $k = 5$

5. (a) $y = \sqrt{9 - x^2}$: semi-circle, radius 3, and centre $(0, 0)$.

$y \le \sqrt{9 - x^2}$: inside of semi-circle, centre $(0, 0)$ and radius 3.



$x - 3y = 3$

x	3	0
y	0	−1

$x - 3y \le 3$

Test (0, 0) $0 \le 3$.

(0, 0) is in region.

Correct region shaded.

(b) $x^2 - 3x - xy + 3y$

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

$= (x-y)(x-3)$.

(c) $a + b\sqrt{2} = \dfrac{\sqrt{2}}{3-2\sqrt{2}} \times \dfrac{3+2\sqrt{2}}{3+2\sqrt{2}}$

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

$= \dfrac{3\sqrt{2}+4}{9-8}$

$= 4 + 3\sqrt{2}$,

$\therefore\ a = 4,\ \ b = 3.$