Sec3 A Math WA3 Mock Exam

Hello my beloved Sec 3s!

Dylan here!

I have created these mock tests for y'all as I found out that I had lack of practice questions when I was in Secondary School.

The difference in the standards between the homework and test questions are way too different.

When my students sit through a Mock Exam prior to their tests, they get use to the time pressure, and they get exposed to the level of the exam questions.

That is the reason why they score really well.

I have a strong desire to help as many students as possible in this community and I want you guys to perform to your best ability.

That is why I want to share these resources with everyone here.

I have purposefully selected questions that cover different scopes in the chapters.

Yes! If you can do these questions, you can certainly do well in your WA3!

Take this test in a quiet environment.

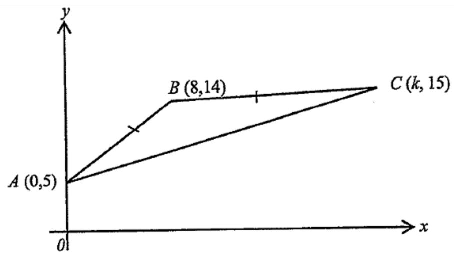
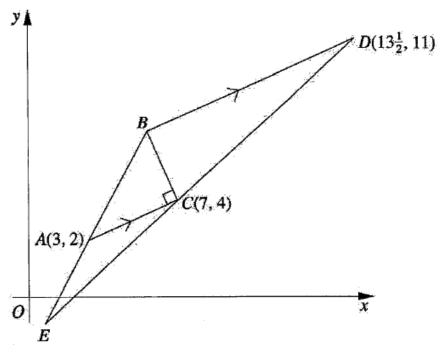
Answers are included at the back, so please don't refer :)

Jiayou!

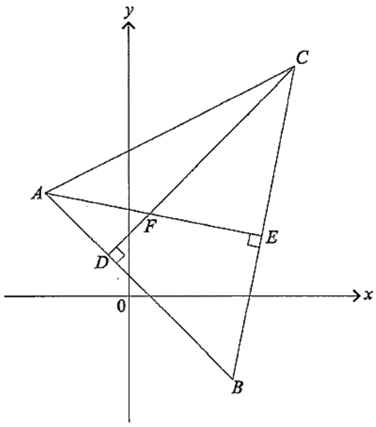
Love,

Dylan

Coordinate Geometry

1	The diagram shows an isosceles triangle ABC with vertices $A\ (0,5), B\ (8,14)$ and $C\ (k, 15)$.  **(a)** Find the value of k. [3] **(b)** D is a point on the x-axis such that $AD = CD$. Find the equation of BD. [3] **(c)** Find the coordinates of D. [2] **(d)** Find the areas of triangle ABC and of quadrilateral $ABCD$. [4]
2	The diagram shows a triangle ABC in which the coordinates of the points A and C are $(3, 2)$ and $(7, 4)$ respectively. $\angle ACB = 90°$. The line BD is parallel to AC and D is the point $\left(13\frac{1}{2}, 11\right)$.The lines BA and DC are extended to meet at E.  Find **(a)** the equation of line BD, [4] **(b)** the coordinates of B, [4] **(c)** the ratio of the area of the quadrilateral $ABDC$ to the area of the triangle BCD. [3]

3



The vertices of the triangle *ABC* have coordinates $(-4,5)$, $(5,-4)$ and $(8,11)$ respectively. *AE* is perpendicular to *BC*, *CD* is perpendicular to *AB*, and *AE* and *CD* meet at *F*.

(a) Find the coordinates of *D* and of *F*. [7]

(b) Find the area of triangle *ABC*. [2]

Linear Law

1	**Answer the whole of this question on a piece of graph paper.**

The table shows experimental values of two variables, x and y, which are connected by an equation of the form $y - b\sqrt{x} = \frac{a}{\sqrt{x}}$, where a and b are constants.

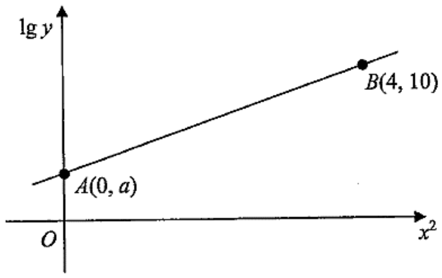
x	1	2	3	4	5	6
y	5	4.95	5.20	5.50	5.81	6.12

(a) Using a scale of 1 cm to represent 1 unit on the $(y\sqrt{x})$-axis and 2 cm to represent 1 unit on the x-axis, plot $y\sqrt{x}$ against x and draw a straight line graph. [4]

(b) Using your graph, estimate the value of a and of b. [3]

(c) Using your graph, estimate the value of y when $x = 4.75$. [2]

2 The variables x and y are related in such a way that, when $\lg y$ is plotted against x^2, a straight line passing through the point A$(0, a)$ and the point $B(4, 10)$ is obtained, as shown in the diagram.



Given that the line has a gradient of 2, find

(a) the value of a, [2]

(b) the expression for y in terms of x, [2]

(c) the values of x when $y = 1000$. [3]

Circles

1	**(a)** Write down the equation of the circle with centre $A(8, 2)$ and radius $\sqrt{80}$. [1] **(b)** This circle intersects the y-axis at points P and Q. Find the length PQ. [3] **(c)** A second circle, centre B, also passes through P and Q. State the y-coordinate of B. [1] **(d)** Given that the x-coordinate of B is negative and that the radius of the second circle is 5, find the x-coordinate of B. [3]
2	The equation of a circle C is $x^2 + 6x + y^2 - 10y = 66$. **(a)** Find the radius and the coordinates of the centre of the circle. [2] **(b)** Given that PQ is the diameter of the circle, where P is the point $(5, 11)$, find the coordinates of the point Q. [3] **(c)** Find the equation of the circle C_1, which is a reflection of the circle C in the line $x = -1$. [2]
3	A circle C_1 has the equation $(x - 4)^2 + (y - 6)^2 = 100$ and another circle C_2 has the equation $x^2 + y^2 + 2x - 16y + 49 = 0$. **(a)** Find the coordinates of the centre of the circle C_2 and its radius. [4] **(b)** Show that C_2 lies completely inside of C_1, [3]

Answer Key

Coordinate Geometry

1

(a)

$AB = BC$

$\sqrt{(8-0)^2+(14-5)^2}=\sqrt{(k-8)^2+(15-14)^2}$

$145 = k^2-16k+65$

$k^2-16k-80=0$

$(k+4)(k-20)=0$

k= -4 (reject) or 20

(b)

BD is the perpendicular bisector of AC.

$MdptAC = (\frac{0+20}{2}, \frac{5+15}{2})$

$=(10,10)$

$GradientAC=\frac{15-5}{20-0}$

$=\frac{1}{2}$

Therefore GradientBD = -2

Equation of BD:

$y-10=-2(x-10)$

$y=-2x+30$

(c) At D, sub $y=0$,

$0=-2x+30$

$x=15$

$D=(15,0)$

(d)

Area $ABC=\frac{1}{2}\begin{vmatrix}0 & 20 & 8 & 0\\ 5 & 15 & 14 & 5\end{vmatrix}$

$=\frac{1}{2}[0+280+40-0-120-100]$

$=50\text{ units}^2$

Area $ABCD=\frac{1}{2}\begin{vmatrix}0 & 15 & 20 & 8 & 0\\ 5 & 0 & 15 & 14 & 5\end{vmatrix}$

$=\frac{1}{2}[0++225+280+40-0-120-0-75]$

$=175\text{ units}^2$

2

(a)

$M_{AC}=\frac{1}{2}$

$M_{BD}=\frac{1}{2}$

Equation of BD:

$y=\frac{1}{2}x+c$

At $\left(13\frac{1}{2},11\right)$

$11=\frac{1}{2}\left(13\frac{1}{2}\right)+c$

$c=\frac{17}{4}$

$y=\frac{1}{2}x+\frac{17}{4}$

(b)

$M_{BC}=-2$

Equation of BC:

$y=2x+c$

At$(7,4)$

$4=-2(7)+c$

$c=18$

$y=-2x+18$

$-2x+18=\frac{1}{2}x+\frac{17}{4}$

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

$y=7$

$B\left(5\frac{1}{2},7\right)$

(c)

Area of $ABDC$

$=\frac{1}{2}\begin{vmatrix}3 & 7 & 13\frac{1}{2} & 5\frac{1}{2} & 3\\ 2 & 4 & 11 & 7 & 2\end{vmatrix}$

$=22.5$units

Area of BCD

$=\frac{1}{2}\begin{vmatrix}5\frac{1}{2} & 7 & 13\frac{1}{2} & 5\frac{1}{2}\\ 7 & 4 & 11 & 7\end{vmatrix}$

$=15$units

Ratio

$=3:2$

3

(a)

(b)

area $=\frac{1}{2}\begin{vmatrix}-4 & 5 & 8 & -4\\ 5 & -4 & 11 & 5\end{vmatrix}$

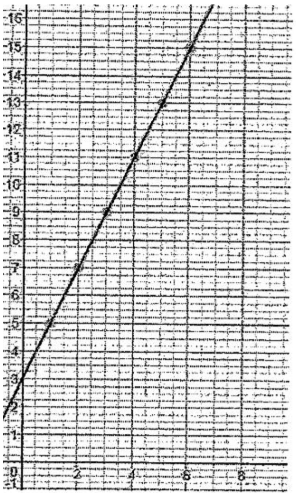
$=81\text{ units}^2$

	$m_{AB}=\frac{-4-5}{5-(-4)}$ $=-1$ $m_{CD}=1$ equation of CD: $y-11=1(x-8)$ $y=x+3$ equation of AB: $y-5=-1(x-(-4))$ $y=-x+1$ $x+3=-x+1$ $x=-1$ $y=2$ $\therefore D(-1,2)$ $m_{BC}=\frac{11-(-4)}{8-5}$ $=5$ $m_{AE}=-\frac{1}{5}$ equation of AE: $y-5=-\frac{1}{5}(x-(-4))$ $y=-\frac{1}{5}x+\frac{21}{5}$ $x+3=-\frac{1}{5}x+\frac{21}{5}$ $5x+15=-x+21$ $6x=6$ $x=1$ $y=4$ $\therefore F(1,4)$	

Linear Law

1 (a)

x	1	2	3	4	5	6
$y\sqrt{x}$	5	7	9	11	13	15



(b)

$y - b\sqrt{x} = \frac{a}{\sqrt{x}}$

$y\sqrt{x} = bx + a$

$a = 3$

$b = \frac{15-13}{6-5} = 2$

(c)

$y\sqrt{x} = 12.5$ (allow for deviation of ± 0.1)

From graph, the point of intersection is $(4.75, 12.5)$ (allow for deviation of ± 0.1)

$y\sqrt{4.75} = 12.5$

$y = 5.74$

2 (a)

$A(0,a), B(4,10)$

$grad = \frac{10-a}{4-0} = 2$

$10 - a = 8$

$a = 2$

(b)

$\lg y = 2x^2 + 2$

$y = 10^{2x^2+2}$

(c)

$\lg 1000 = 2x^2 + 2$

$3 = 2x^2 + 2$

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

$x = \pm 0.707$

3 (a)

$x^2 + y^2 + 2x - 16y + 49 = 0$

$(x+1)^2 + (y-8)^2 - 1 - 64 + 49 = 0$

$(x+1)^2 + (y-8)^2 = 16$

centre $= (-1, 8)$

radius $= 4$ units

(b)

let the centres of C_1 and C_2 be O_1 and O_2 respectively

$O_1O_2 = \sqrt{(8-6)^2 + (-1-4)^2}$

$= \sqrt{29}$

since $\sqrt{29} + 4 < 10$,

therefore C_2 lies completely inside C_1.

Circles

1	**(a)** Eqn of circle: $(x-8)^2+(y-2)^2=80$	**(b)** $x=0,\quad 64+y^2-4y+4=80$ $y^2-4y-12=0$ $(y-6)(y+2)=0$ $y=6$ or -2 Length $PQ=6-(-2)$ $=8$ units
	(c) y-coordinate of $B=2$	**(d)** Let B be $(k,2)$ Length $BP=5$ $\sqrt{(k-0)^2+(2-6)^2}=5$ $k^2+16=25$ $k^2=9$ $k=3$(reject) or -3
2	**(a)** $x^2+6x+y^2-10y=66$ Centre = (-3, 5), $radius=\sqrt{9+25-(-66)}$ $=10units$	**(b)** Midpoint of PQ = centre of circle $\left(\frac{5+a}{2},\frac{11+b}{2}\right)=(-3,5)$ $\therefore \frac{5+a}{2}=-3\Rightarrow a=-11$ $\frac{11+b}{2}=5\Rightarrow b=-1$ $Q(-11,-1)$ **(c)** New centre = (1, 5), $r=10$ $(x-1)^2+(y-5)^2=100$.
3	**(a)** $x^2+y^2+2x-16y+49=0$ $(x+1)^2+(y-8)^2-1-64+49=0$ $(x+1)^2+(y-8)^2=16$ centre $=(-1,8)$ radius $=4$ units	**(b)** let the centres of C_1 and C_2 be O_1 and O_2 respectively $O_1O_2=\sqrt{(8-6)^2+(-1-4)^2}$ $=\sqrt{29}$ since $\sqrt{29}+4<10$, therefore C_2 lies completely inside C_1.