**RAFFLES INSTITUTION**
**MATHEMATICS DEPARTMENT**
**2024 YEAR 3 RP MATHEMATICS**
**TOPIC 5: COORDINATE GEOMETRY (MATHS 1 & MATHS 2)**

**SUPPLEMENTARY WORKSHEET**

Name: Class: 3 ( ) Date:

**1** **2022/Y3RP/M2/T1/Q3**

The equation of a circle, $C_1$, with centre $A$, is $x^2+y^2-6x-4y=87$.

(i) Find the coordinates of $A$ and the radius of $C_1$. [3]

(ii) The point $P(11, 8)$ lies on $C_1$. Find the equation of the tangent to $C_1$ at $P$. [2]

(iii) Determine if the point $Q(9,-7)$ lies inside $C_1$. Justify your answer. [2]

*[Ans: (i) A(3, 2), 10 units (ii) $y=-\frac{4}{3}x+\frac{68}{3}$ (iii) No]*

**2** **2022/Y3RP/M2/T1/Q4**

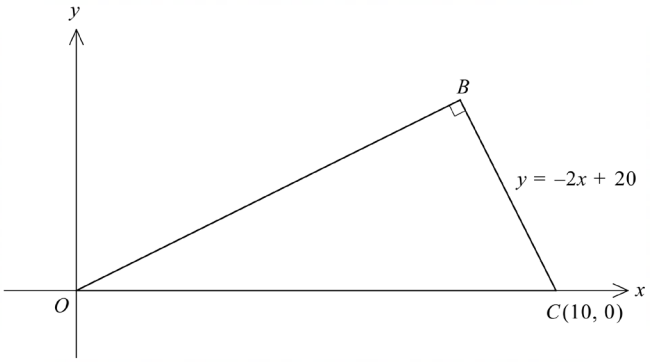
The diagram shows a right-angled triangle $OBC$, where $O$ is the origin and the point $C$ is at $(10, 0)$. $OB$ is perpendicular to $BC$ and the equation of $BC$ is $y=-2x+20$. Point $D$ lies on $BC$ produced such that $BD:CD=7:2$.

(i) Show that the coordinates of point $B$ are $(8, 4)$. [2]

(ii) Find the coordinates of $D$. [2]

(iii) Explain why it is possible to draw a circle passing through $O$, $B$ and $D$. [1]

(iv) Given that point $A$ is a reflection of point $B$ in the $x$-axis, find the area of triangle $ACD$. [3]




*[Ans: (ii) $D\left(10\frac{4}{5}, -1\frac{3}{5}\right)$ (iv) $3\frac{1}{5}$ units$^2$]*

**3** **2021/Y3RP/M2/T1/Q2**

**Solution to this question by accurate drawing will not be accepted.**

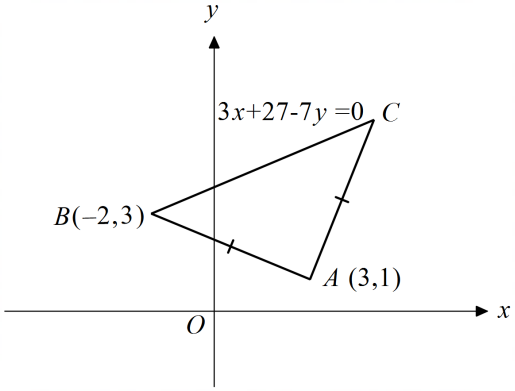
The diagram shows an isosceles triangle $ABC$ with vertices $A(3,1)$ and $B(-2,3)$ and $AB=AC$. The equation of the line $BC$ is $3x+27-7y=0$. Find

**(i)** the equation of the perpendicular bisector of $BC$, [2]

**(ii)** the coordinates of the mid-point, $M$, of $BC$, [3]

**(iii)** the area of triangle $ABC$. [2]

**(iv)** the coordinates of the point $P$ which lies on $AB$ produced such that $AB:AP=2:3$. [2]




*[Ans:(i) $y=-\frac{7}{3}x+8$ (ii) $\left(1\frac{1}{2}, 4\frac{1}{2}\right)$ (iii) $14\frac{1}{2}$ units$^2$ (iv) $\left(-4\frac{1}{2}, 4\right)$]*

**4** **2021/Y3RP/M2/T1/Q5**

A circle passes through the points $A(3,0)$ and $B(-1,8)$. The $x$-axis is a tangent to the circle at $A$.

**(i)** Explain briefly why the $x$-coordinate of the centre of the circle is 3. [1]

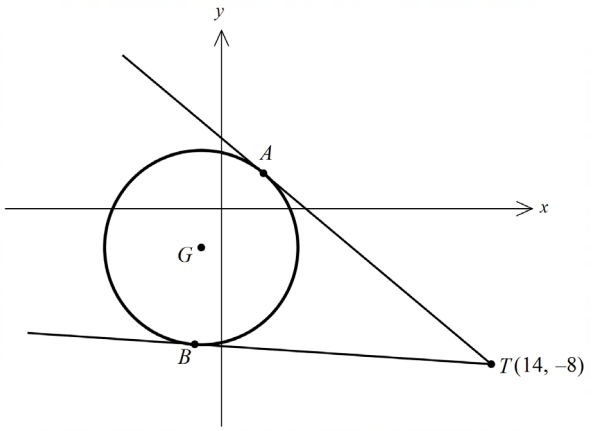
**(ii)** Find the equation of the circle. [3]

*[Ans: (ii) $(x-3)^2+(y-5)^2=2$]*

**5** **2020/Y3RP/M2/T1/Q4**

**Solutions to this question by accurate drawing will not be accepted.**

The diagram shows a circle $x^2+y^2+2x+4y-20=0$ with centre $G$. $TA$ and $TB$ are tangents to the circle at $A$ and $B$ respectively from point $T(14,-8)$.




**(i)** State the centre $G$ of the circle. [1]

**(ii)** Find the length of $GT$, leaving your answer in surd form. [2]

**(iii)** Explain why $GT$ is the diameter of the circle that passes through the points $A, G, B$ and $T$. Hence, find the equation of this circle. [3]

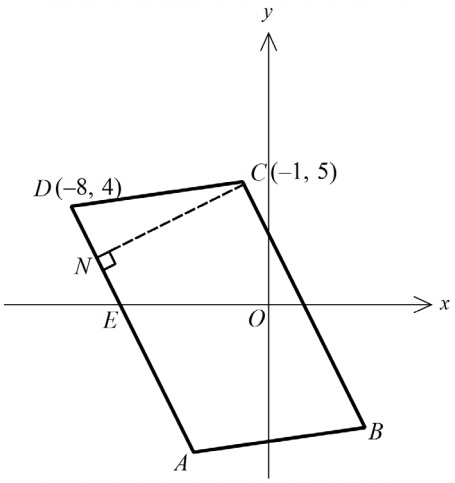
*[Ans: (i) $(-1,-2)$ (ii) $3\sqrt{29}$ units*

*(iii) $\left(x-\frac{13}{2}\right)^2+(y+5)^2=\frac{261}{4}$]*

**6** **2020/Y3RP/M2/T1/Q5**

**Solutions to this question by accurate drawing will not be accepted.**

In the diagram, $ABCD$ is a parallelogram in which $C$ is $(-1,5)$, $D$ is $(-8,4)$, $N$ is the foot of the perpendicular from $C$ to $AD$ and $DN=\frac{1}{5}DA$. The equation of the line $AD$ is $2x+y+12=0$ and it cuts the $x$-axis at $E$. Find




**(i)** the equation of $CN$. [2]

**(ii)** the coordinates of $N$. [2]

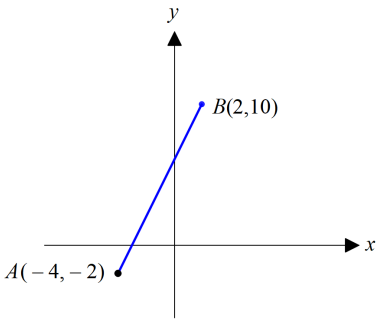
**(iii)** the coordinates of $A$, [2]

**(iv)** the area of quadrilateral $OCDE$. [3]

*[Ans:(i) $y=\frac{1}{2}x+\frac{11}{2}$ (ii) $(-7,2)$ (iii) $(-3,-6)$ (iv)30 units$^2$]*

**7** **2019/Y3RP/M1/T1/Q3**

The diagram shows a line segment $AB$ where $A$ is the point $(-4,-2)$ and $B$ is the point $(2,10)$.




**(i)** Find the equation of the perpendicular bisector of $AB$. [3]

**(ii)** $C(k,-2)$ is a point on the perpendicular bisector of $AB$, find the value of $k$. [2]

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

**(iv)** $D$ is a point on the $y$-axis such that the area of triangle $ACD$ is equal to the area of triangle $ABC$. Write down all the possible coordinates of $D$. [2]

*[Ans: (i) $y=-\frac{1}{2}x+\frac{7}{2}$ (ii) $k=11$ (iii) 90 units$^2$ (iv) $(0,10)$ or $(0,-14)$]*

**8** **2019/Y3RP/M2/T1/Q4**

A circle $C_1$ touches the lines $x = 4$ and $y = -2$ at points $A$ and $B$ respectively. The centre of the circle lies on the line $3x + 2y = 0$. The value of the $x$-coordinate of the centre is negative.

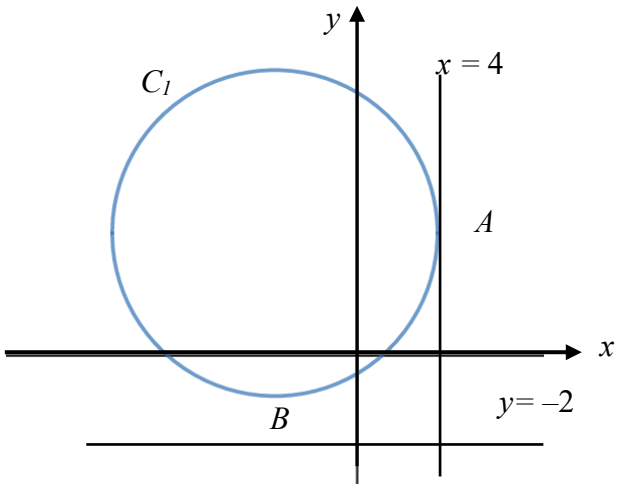
**(i)** Show that the centre of $C_1$ is $(-4, 6)$. [2]

**(ii)** Find the radius and hence write down the equation of the circle. [2]

A point $P$ lies on $BA$ produced such that $BA : BP = 2 : 3$. A point $H$ is the highest point on $C_1$.

**(iii)** Find the coordinates of $P$. [2]

**(iv)** Find the area of triangle $APH$. [3]




*[Ans: (ii) 8 units, $(x+4)^2+(y-6)^2=64$ (iii) P(8, 10) (iv) 32 units$^2$]*

**9** **2018/Y3RP/M1/T1/Q5**

**Solutions to this question by accurate drawing will not be accepted.**

Two points have coordinates $A$ (–1, –3) and $C$ (–7, –7). $B$ is the point on the $y$-axis and $ABCD$ is a rhombus.

(a) Find the equation of the perpendicular bisector of $AC$. [3]

(b) Calculate the coordinates of $B$ and $D$. [3]

*[Ans: (a) $y=-\frac{3}{2}x-11$ (b) $B\ (0,-11)$, $D\ (-8,1)$ ]*

**10** **2018/Y3RP/M2/T1/Q7**

A circle $C_1$ is given by the equation $x^2 + y^2 + 8x - 2y - 3 = 0$.

**(i)** Find the coordinates of the centre and the radius of circle $C_1$. [2]

Another circle $C_2$ of centre $(2, 4)$ and radius $\sqrt{5}$ unit touches the circle $C_1$ at point $P$. Find

**(ii)** the coordinates of point $P$, [2]

**(iii)** the equation of the common tangent to circles $C_1$ and $C_2$ at point $P$. [2]

*[Ans: (i) Centre $=(-4,1)$, Radius $=2\sqrt{5}$ units (ii) (0, 3) (iii) $y=-2x+3$ ]*

**11** **2017/Y3RP/T1/Q3**

**Solutions to this question by accurate drawing will not be accepted.**

In the diagram, $EF$ is parallel to $HG$ and the coordinates of $E$, $F$ and $G$ are $(2,10),(8,12)$ and $(13,7)$. It is also given that $H$ lies on the line $y = x$. Find

(i) the equation of $EF$, [2]

(ii) the coordinates of the point $H$, [2]

(iii) the area of the quadrilateral $EFGH$. [2]

*[Ans: (i) $y=\frac{1}{3}x+\frac{28}{3}$ (ii) (4, 4) (iii) 50 units$^2$]*

**12** **2017/Y3RP/T1/Q5**

A circle $C$ passes through the points $A(-6,10)$ and $B(-3,1)$.

(i) Given that the centre of $C$ lies on the line $y=-\frac{3}{2}x-4$, find the equation of $C$. [5]

(ii) Write down the equations of the tangents to the circle that are parallel to the $x$-axis. [1]

*[Ans: (i) $(x+6)^2+(y-5)^2=25$ (ii) $y = 0$ and $y = 10$]*

**13** **2016/Y3RP/T1/Q5**

The equation of a circle is $x^2+y^2+6x-14y+17=0$.

**(i)** Find the centre and radius of the circle. [3]

**(ii)** Show that the point $(-8,3)$ lies on the circle. [1]

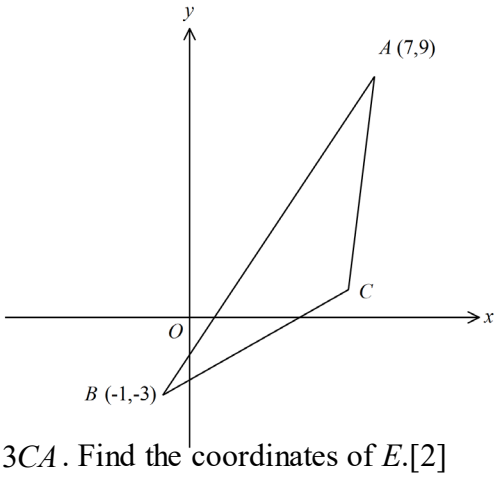
**(iii)** Find the equation of the line which is a tangent to the circle at the point (-8, 3).[2]

*[Ans: (i) (−3, 7), $\sqrt{41}$ unites (iii) $y=-\frac{5}{4}x-7$]*

**14** **2016/Y3RP/T1/Q6**

**Solution to this question by accurate drawing will not be accepted.**

The diagram, which is not drawn to scale, shows a triangle $ABC$ in which the point $A$ is $(7,9)$ and the point $B$ is $(-1,-3)$. The point $C$ lies on the perpendicular bisector of $AB$ and the equation of the line $AC$ is $y=8x-47$. Find




**(i)** the equation of the perpendicular bisector of $AB$, [3]

**(ii)** the coordinates of $C$. [2]

The point $D$ is such that $ACBD$ is a rhombus,

**(iii)** Find the coordinates of $D$. [2]

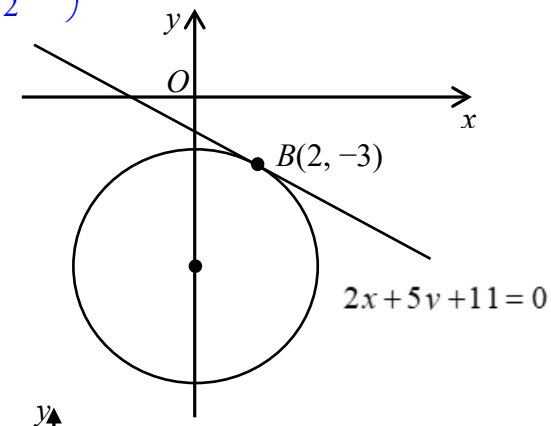
**(iv)** Show that $AB=2CD$. [2]

**(v)** $E$ is a point on $CA$ produced such that $2CE=3CA$. Find the coordinates of $E$.[2]

*[Ans: (i) $y=-\frac{2}{3}x+5$ (ii) (6, 1) (iii) (0, 5) (v) $\left(7\frac{1}{2},13\right)$]*

**15** **2015/Y3RP/T1/Q4**

The diagram, which is not drawn to scale, shows a circle with centre $A$ and the tangent to the circle at $B(2,-3)$. The centre of the circle lies on the $y$-axis and the equation of the tangent is $2x+5y+11=0$.




**(a)** Find the coordinates of $A$. [2]

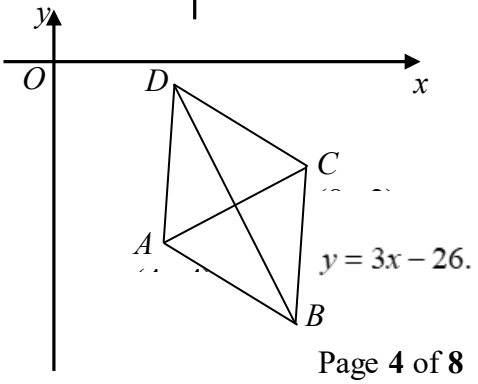
**(b)** Find the equation of the circle. [2]

*[Ans: (a) (0, −8) (b) $x^2+(y+8)^2=29$]*

**16** **2015/Y3RP/T1/Q5**

**Solutions to this question by accurate drawing will not be accepted.**

The diagram, which is not drawn to scale, shows a rhombus $ABCD$ in which $A$ is $(4,-4)$, $C$ is (8, −2) and equation of $BC$ is $y=3x-26$.




**(a)** Find the equation of $BD$. [3]

**(b)** Find the coordinates of $B$. [2]

Given that $N$ is a point on $AC$ produced such that $AC : AN = 2 : 5$,

**(c)** find the coordinates of $N$, [2]

**(d)** find the area of the quadrilateral $ABND$. [2]

*[Ans: (a) $y = -2x + 9$ (b) (7, −5) (c) (14, 1) (d) 25 units²]*

**17** **2014/Y3RP/T2/Q3**

The equation of a circle is $x^2 + y^2 - kx + (k+2)y - 15 = 0$, where $k$ is a constant. The centre of the circle is on the line $2x + 5y + 14 = 0$. Find

(a) the value of $k$, [2]

(b) the coordinates of the centre of the circle, [1]

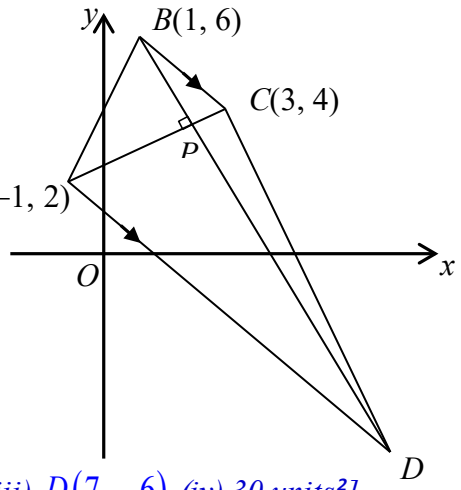
(c) the area of the circle, leaving your answer in terms of π. [2]

*[Ans: (a) $k = 6$ (b) (3, −4) (c) $40\pi$ units²]*

**18** **2014/Y3RP/T2/Q5**

**Solutions to this question by accurate drawing will not be accepted.**

The diagram shows a trapezium $ABCD$ with vertices $A(-1, 2)$, $B(1, 6)$ and $C(3, 4)$. The line through $A$ parallel to $BC$ meets the line through $B$ perpendicular to $AC$ at point $D$. $P$ is the point where $AC$ and $BD$ meet and $AP : AC = 4 : 5$. Find




(i) the coordinates of $P$, [2]

(ii) the equation of $BD$, [2]

(iii) the coordinates of $D$, [4]

(iv) the area of trapezium $ABCD$. [2]

*[Ans: (i) $P\left(2\frac{1}{5}, 3\frac{3}{5}\right)$ (ii) $y = -2x + 8$ (iii) $D(7, -6)$ (iv) 30 units²]*

**19** **2013/Y3RP/T2/Q4**

A circle $B$ has equation $x^2 + y^2 + 4x - 2y + k = 0$, where $k$ is a constant. It is also given that the radius of Circle $B$ is 6 units.

**(a)** **(i)** Find the coordinates of the center of the circle $B$. [2]

**(ii)** Calculate the value of $k$. [2]

**(b)** Another circle $Q$ is a reflection of circle $B$ in the $y$-axis.
State the equation of circle $Q$. [1]

*[Ans: (a)(i) (−2, 1) (ii) −31 (b) $(x-2)^2 + (y-1)^2 = 36$]*

**20** **2013/Y3RP/T2/Q5**

**Solutions to the following question by accurate drawing will not be accepted.**

The diagram shows a kite $PQRS$ with $PQ = PS$ and $RQ = RS$. The point $P$ lies on the $y$-axis, $Q$ is (2, 8), $S$ is (3, 3) and the equation of $RS$ is $y = 2x - 3$.

**(i)** Show that the equation of $PR$ is $y = \frac{1}{5}x + 5$. [3]

Calculate the

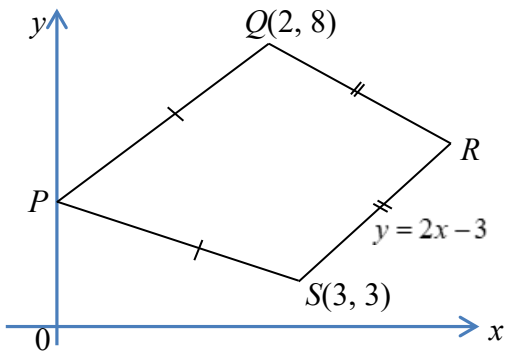
**(ii)** coordinates of $R$, [2]

**(iii)** area of the kite $PQRS$. [2]

The diagonal $QS$ meets the diagonal $PR$ at $W$.

**(iv)** Find the ratio of $PW : WR$. [2]

*[Ans: (ii) $R\left(4\frac{4}{9}, 5\frac{8}{9}\right)$ (iii) $11\frac{5}{9}$ units² (iv) 9 : 7]*



**21** **2012/Y3RP/T1/Q3**

Given that the coordinates of $B$ and $C$ are $(-1,-2)$ and $(3,10)$ respectively and $Q$ is a point on $BC$ such that $BQ : QC = 3 : 1$.

(i) Find the coordinates of $Q$. [2]

$P$ is a point on the $x$-axis such that area of triangle $CPQ$ is 5 units$^2$.

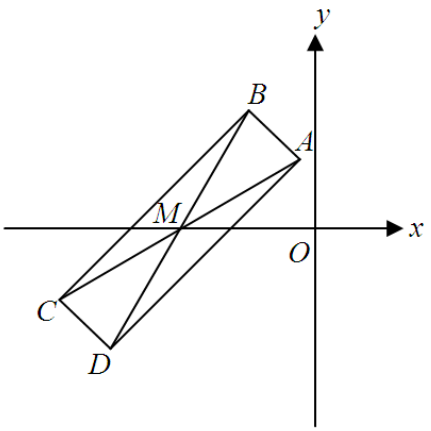
(ii) Find the possible coordinates of $P$. [3]

*[Ans: (i) (2, 7) (ii) (3,0) or $\left(-3\frac{2}{3},0\right)$]*

**22** **2012/Y3RP/T1/Q4**

**Solutions to this question by accurate drawing will not be accepted.**

The diagram shows a rectangle $ABCD$ where $A$ and $B$ are the points $(-1, 3)$ and $(-2, 6)$ respectively. The diagonals intersect each other at point $M$ which lies on the $x$-axis.




(i) Find the equation of the line $AD$. [3]

(ii) Show that the coordinates of $M$ is given by $(-15, 0)$. [2]

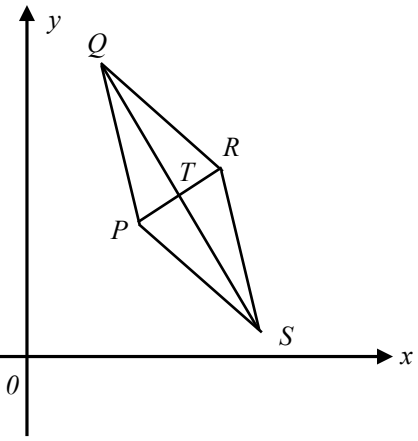
(iii) Find the equation of the circle passing through $ABCD$. [3]

*[Ans: (i) $y=\frac{1}{3}x+\frac{10}{3}$ (iii) $(x+15)^2+y^2=205$]*

**23** **2011/Y3RP/T1/Q3**

**Solutions to this question by accurate drawing will not be accepted.**

In the figure, $PQRS$ is a rhombus. $P$ lies on the line $y=4$ and $S$ lies on the line $2y+x=13$. The diagonals $PR$ and $QS$ meet at $T\left(7,5\frac{1}{2}\right)$. It is also given that the gradient of the diagonal $PR$ is $\frac{3}{4}$. Find




(a) the coordinates of $P$ and $R$, [4]

(b) the equation of the diagonal $QS$, [2]

(c) the coordinates of $S$, [2]

(d) the area of $\Delta PTS$ and [2]

(e) the equation of the circle with centre $T$ and passing through $S$. [2]

*[Ans:(a)P(5, 4),R(9, 7)(b) $y=-\frac{4}{3}x+\frac{89}{6}$(c)$\left(10,1\frac{1}{2}\right)$ (d ) $6\frac{1}{4}$ units$^2$(e) $(x-7)^2+\left(y-\frac{11}{2}\right)^2=25$]*

**24** **2009/Y3RP/T1/Q3**

By expressing the equation of the circle $x^2+y^2+3x-7y+9=0$ in the form $(x-a)^2+(y-b)^2=r^2$, state the coordinates of the centre of the circle and the exact length of its radius. [3]

*[Ans: $\left(-1\frac{1}{2},3\frac{1}{2}\right)$, $\frac{\sqrt{22}}{2}$ units]*

**25** **2009/Y3RP/T1/Q4**

**Solutions to this question by accurate drawing will not be accepted.**

The diagram shows a parallelogram $ABCD$ in which $A$ is $(8, 2)$ and $B$ is $(2, 6)$. The equation of $BC$ is $2y - x = 10$ and $E$ is the point on $BC$ such that $AE$ is perpendicular to $BC$. Find

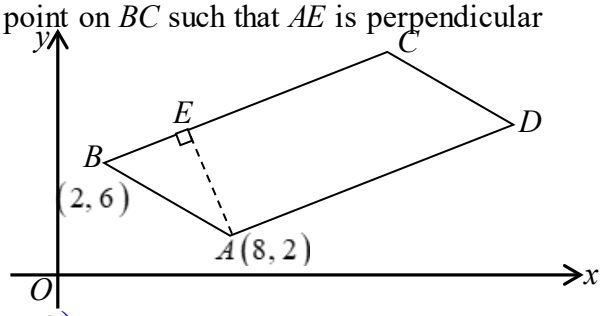
(i) the equation of $AE$, [2]

(ii) the coordinates of $E$. [2]

Given also that $BC = 5\,BE$, find

(iii) the coordinates of $C$ and of $D$, [4]

(iv) the area of the parallelogram $ABCD$. [2]




*[Ans: (i) $y = -2x + 18$ (ii) $\left(5\frac{1}{5}, 7\frac{3}{5}\right)$ (iii) (18, 14), (24, 10) (iv) 112 units$^2$]*

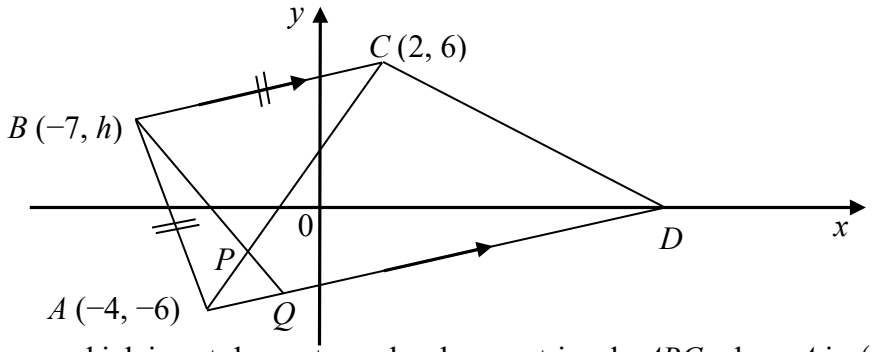
**26** **2008/Y3RP/T1/Q5**

Express the equation of the circle $x^2 + y^2 - 14x - 8y + 10 = 0$ in the form $(x-a)^2 + (y-b)^2 = r^2$, hence state its centre and radius in surd form. [3]

*[Ans: $(x-7)^2 + (y-4)^2 = \left(\sqrt{55}\right)^2$, $(7, 4)$, $\sqrt{55}$ units]*

**27** **2008/Y3RP/T1/Q6**

**Solutions to this question by accurate drawing will not be accepted.**




The diagram, which is not drawn to scale, shows a triangle $ABC$ where $A$ is $(-4, -6)$, $B$ is $(-7, h)$ and $C$ is $(2, 6)$. Given that $AB = BC$ and $D$ is a point on the $x$-axis such that $AD$ is parallel to $BC$ and $P$ is a point on $AC$ such that the area of triangle $ABP$ is $\frac{1}{3}$ the area of triangle $ABC$. The line $BP$ produced meets the line $AD$ at $Q$.

(i) Show that the value of $h$ is 3. [3]

(ii) Show that $\angle ABC = 90^\circ$. [2]

(iii) Find the coordinates of $D$ and of $P$. [5]

(iv) The point $G$ is such that $ABCG$ is a square. Find the coordinates of $G$. [2]

(v) Find the area of triangle $ABC$. [2]

*[Ans: (iii) D(14, 0), P(−2, −2) (iv) G(5, −3) (v) 45 units$^2$]*

**28** **2007/Y3RP/T2/Q4**

The equation of a circle is $x^2 + y^2 - 5x - 8y + 16 = 0$.

(i) Find the coordinates of the centre and the radius of the circle. [3]

(ii) Find the equation of the tangent to the circle at the point (4, 2). [3]

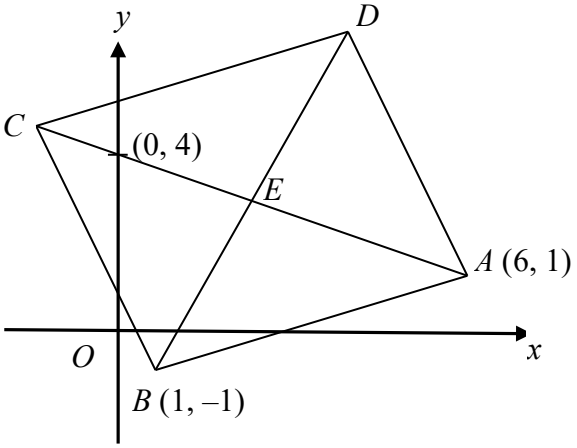
*[Ans: (i) Centre $\left(2\frac{1}{2}, 4\right)$, radius $= 2\frac{1}{2}$ units (ii) $y = \frac{3}{4}x - 1$]*

**29** **2007/Y3RP/T1/Q3**

***Solutions to this question by accurate drawing will not be accepted.***

$ABCD$ is a parallelogram with $A$ (6, 1) and $B$ (1, –1). $AC$ and $BD$ intersect at $E$. $BD$ is perpendicular to $x+4y=5$. $AC$ cuts the $y$-axis at (0, 4). Find

(i) the equation of $AC$, [2]
(ii) the equation of $BD$, [2]
(iii) the coordinates of $E$ and $C$, [4]
(iv) the area of $ABCD$, [2]
(v) the perpendicular distance of $B$ from $AC$ in surd form. [3]




*[Ans:(i) $y=-\frac{1}{2}x+4$ (ii) $y=4x-5$ (iii) $E(2,\ 3); C(-2,\ 5)$ (iv) 36 sq units (v) $\frac{9\sqrt{5}}{5}$ units ]*

**30** **2006/Y3RP/T2/Q5**

A circle has equation $x^2-4x+y^2+7y=0$.

(a) Find the coordinates of the centre and the exact radius of the circle. [3]
(b) A point $(-2,-3)$ lies on the circle. Find the equation of the tangent to the circle passing through this point. [3]

*[Ans(a): $\left(2,-3\frac{1}{2}\right)$, radius $\frac{\sqrt{65}}{2}$ units (b) $y = 8x + 13$]*

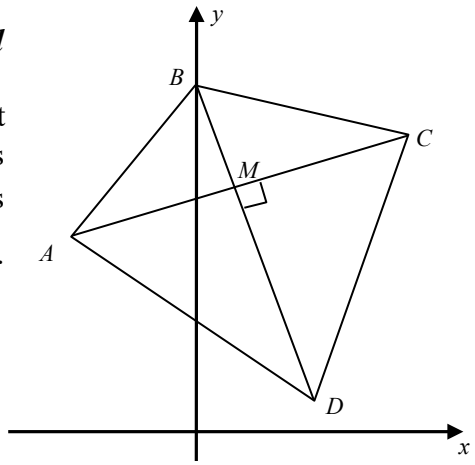
**31** **2006/Y3RP/T2/Q5**

***Solution of this question by accurate drawing will not be accepted.***

The diagram shows a quadrilateral $ABCD$ (not drawn to scale) where $A$ is $(-2,5)$, $B$ is on the $y$-axis and $C$ is $(4,7)$. The diagonals intersect at $M$, $BD$ is the perpendicular bisector of $AC$ and $BD=\frac{5}{2}BM$.

Find

(i) the equation of $BD$, [3]
(ii) the coordinates of $B$, [1]
(iii) the coordinates of $D$, [4]
(iv) the area of the triangle $ABC$. [2]




*[Ans (i) $y=-3x+9$ (ii) (0, 9) (iii) $D=\left(2\frac{1}{2},1\frac{1}{2}\right)$ (iv) 10 units$^2$ ]*

**32** **2005/Y3RP/T1/Q7**

$P$ is the point (5, −2) and the line joining the points $P$ and $Q$ is parallel to the line $2x+3y=0$. The perpendicular bisector of $PQ$ passes through the point (4, 3). Find

**(a)** the equation of $PQ$,
**(b)** the equation of perpendicular bisector of $PQ$,
**(c)** the perpendicular distance from (4, 3) to the line $PQ$ in surd form,
**(d)** the coordinates of $Q$. [10]

*[Ans: (a) $y=-\frac{2}{3}x+1\frac{1}{3}$ (b) $y=\frac{3}{2}x-3$ (c) $\sqrt{13}$ units (d) (−1, 2)]*