INDICES

1. **1989 Q4 P2**

   Simplify $\dfrac{25^{3/4}\times 0.9^2\times 2^2}{5^{5/2}\times 3^3}$

   in the form $^A/_B$ where A and B are integers (2 marks)

2. **1990 Q4 P2**

   Solve for x in

   $$5^{2x\text{-}1} = 12^x \qquad \text{(3 marks)}$$

3. **1991 Q 4 P2**

   Solve for x in

   $$4^{x+1} = 32 \qquad \text{(3 marks)}$$

4. **1993 Q8 P2**

   Solve for x in

   $$9^x + 3^{2x} - 1 = 53 \qquad \text{(3 marks)}$$

5. **1995 Q 5 P2**

   Find the value of x in the following equations:
   $$49^{x+1} + 7^{2x} = 350 \qquad \text{(4 marks)}$$

6. **1996 Q 9 P2**

   Find the value of x which satisfies the equation (4 marks)
   $$16^{x^2} = 8^{4x\text{-}3}$$

7. **1997 Q 7 P2**

   Find the value of m in the following equation
   $$(^1/_{27})^{\,m}\, x\, (81)^{\text{-}1} = 243 \qquad \text{(3 marks)}$$

8. **1998 Q 10 P2**

   Given that P = 3^y, express the equation $3^{2y-1} + 2\ x\ 3^{y\text{-}1} = 1$ terms of P. (1mark)
   Hence or otherwise find the value of y in the equation
   $$3^{2y-1} + 2\ x\ 3^{y\text{-}1} \qquad \text{(3 marks)}$$

9. **1999 Q 4 P2**

   Simplify $\sqrt{2^x \times 5^{2x} \div 2^{-x}}$ (2 marks)

10. 2000 Q 12 P2

Find the value of x which satisfy the equation

$$5^{2x} - 6 \times 5^x + 5 = 0$$ (4 marks)

11. 2001 Q 2 P2

Solve for x in the equation $32^{(x-3)} \div 8^{(x+4)} = 64 \div 2^x$ (3 marks)

12. 2002 Q 7 P2

Solve for x in the equation $\dfrac{81^{2x} \times 27^x}{9^x} = 729$ (3 marks)

13. 2005 Q 1 P2

Find the value of y in the equation

$$\dfrac{243 \times 3^{2y}}{729 \times 3^y \div 3^{(2y-1)}} = 81$$ (3 marks)

14. 2008 Q 2 P1

Simplify

$$\dfrac{27^{\frac{2}{3}} \div 2^4}{32^{-\frac{3}{5}}}$$ (3 marks)

15. 2009 Q 5 P1

Without using logarithm tables or calculators, evaluate

$$\dfrac{64^{-\frac{1}{2}} \times 27000^{\frac{2}{3}}}{2^{-4} \times 3^0 \times 5^2}$$ (4 marks)

16. 2010 Q 8 P1

Without using mathematical tables or a calculator, evaluate

$$27^{\frac{2}{3}} \times \left(\dfrac{81}{16}\right)^{-\frac{1}{4}}$$ (3 marks)

17. **2012 Q5 P1**

   Given that 9^{2y} x 2^x =72, find the values of x and y (3 marks)

18. **2014 Q6 P1**

   Simplify $\dfrac{243^{\frac{-2}{5}} \times 125^{\frac{2}{3}}}{9^{\frac{-3}{2}}}$ (3marks)

19. **2016 Q8 P1**

   Without using mathematical tables or a calculator, evaluate

   $$27^{\frac{2}{3}} \times \left(\frac{81}{16}\right)^{-\frac{1}{4}}$$ (3 marks)

EVALUATION OF NUMERIC EXPRESSIONS
(Using Mathematical tables)

1. **1989 Q1 P1**

   Use logarithms to evaluate (4 marks)

   $$\sqrt[3]{(35.6 \times 0.0613^2)}$$

2. **1990 Q1 P2**

   Evaluate $\dfrac{1.34}{(5.24)^{0.8} \times 0.0029}$ (4 marks)

3. **1991 Q1 P2**

   Use mathematical tables to evaluate (3 marks)

   $$\sqrt{\left[\frac{2.935 \times 0.0765}{32.74}\right]}$$

4. 1992 Q1 P1

Use logarithms to evaluate $\sqrt[3]{\left[\dfrac{7.08}{76.8 \times 7.034}\right]}$ (4 marks)

5. 1993 Q2 P1

Use logarithms to evaluate $\dfrac{\sqrt{0.0645}}{0.0082}$ (3 marks)

6. 1994 Q1 P1

Use logarithms to evaluate

$\sqrt[4]{\dfrac{4.562 \times 0.038}{0.82}}$ (4 marks)

7. 1995 Q1 P2

Use logarithms to evaluate (4 marks)

$\dfrac{(0.07284)^2}{3\sqrt{0.06195}}$

8. 1996 Q1 P1

Use logarithms to evaluate $3\sqrt{\dfrac{36.15 \times 0.02573}{1.938}}$ (3 marks)

9. 1997 Q1 P1

Use logarithms to evaluate $\dfrac{(1934)^2 \times \sqrt{0.00324}}{436}$ (4 marks)

10. 1998 Q1 P2

Use logarithms to evaluate $55.9 \div (0.2621 \times 0.01177)^{\frac{1}{5}}$ (4 marks)

11. 1999 Q1 P2

Use logarithms to evaluate $\left(\dfrac{6.79 \times 0.3911}{\log 5} \right)^{\frac{3}{4}}$ (4 marks)

12. 2000 Q11 P2

Use the logarithms to evaluate $3\sqrt{\dfrac{1.23 \times 0.0089}{76.54}}$ (4 marks)

13. 2001 Q1 P1

Find the reciprocal of 0.342. Hence evaluate:

$\dfrac{\sqrt{0.0625}}{0.342}$ (3 marks)

14. 2001 Q3 P1

Use logarithms to evaluate

$\left(3.256 \times 0.0536 \right)^{\frac{1}{3}}$ (4 marks)

15. 2002 Q1 P2

Use logarithms to evaluate $\dfrac{(0.0056)^{1/2}}{1.38 \times 27.42}$ (3 marks)

16. 2002 Q5 P1

Use reciprocal and square tables to evaluate, to 4 significant figures, the

expression: $\dfrac{1}{24.56} + 4.346^{2}$ (3 marks)

17. 2003 Q1 P2

Use logarithm tables to evaluate $\dfrac{2347 \times 0.4666}{3\sqrt{0.0924}}$ (4 marks)

18. 2004 Q1 P2

Use logarithms to evaluate $\dfrac{34.33}{\sqrt{5.25 \times 0.042}}$ (4 marks)

19. 2004 Q8 P1

Use tables of reciprocals only to work out

$$\frac{3}{0.6735} + \frac{13}{0.156}$$

(3 marks)

20. 2006 Q1 P2

In this question, show all the steps in your calculations, giving your answers at each stage
Use logarithms, correct to 4 decimal places, to evaluate

(4 marks)

$$3\sqrt{\frac{36.72 \times (0.46)^2}{185.4}}$$

21. 2007 Q1 P2

Using logarithm tables, evaluate $\left(\frac{0.032 \times 14.26}{0.006}\right)^{\frac{2}{3}}$

(3 marks)

22. 2008 Q1 P2

In this question, show all the steps in your calculations, giving the answer at each stage. Use logarithms correct to decimal places, to evaluate.

$$\frac{6.373 \log 4.948}{\sqrt{0.004636}}$$

(3 marks)

23. 2011 Q1 P2

Use logarithms, correct to 4 decimal places, to evaluate

$$3\sqrt{\frac{83.46 \times 0.0054}{1.56^2}}$$

(4 marks)

24. 2012 Q2 P1

Find the reciprocal of 0.216 correct to 3decimal places, hence evaluate

(3 marks)

$$\frac{\sqrt[3]{0.512}}{0.216}$$

25.   **2015 Q4 P1**

Use logarithms, correct to 4 significant figures, to evaluate

$$\sqrt{\frac{72.56 \times 0.64}{(1.845)^2}}$$

(4 marks)

EQUATIONS OF STRAIGHT LINES

1.   1989 Q23 P1

A rhombus PQRS is such that Q lies on the x axis. The coordinates of vertices
P and R are (2, 4) and (6, 2) respectively.

Determine

- The coordinates of Q   (4 marks)
- The coordinates of S   (4 marks)

2.   1992 Q9 P2

A perpendicular is drawn from a point (3, 5) to the line 2y + x = 3. Find the
equation of the perpendicular.   (3 marks)

3.   1995 Q 5 P1

A perpendicular to the line y - 4x + 3 = 0 passes through the point (-8, 5)
Determine its equation   (2 marks)

4.   1997 Q 24 P1

The co-ordinates of the points P and Q are (1, -2) and (4, 10) respectively.
A point T divides the line PQ in the ratio 2: 1

(a) Determine the coordinates of T   (2 marks)

(b) (i) Find the gradient of a line perpendicular to PQ   (2 marks)
     (ii) Hence determine the equation of the line perpendicular PQ and

passing through T   (2 marks)

(iii) If the line meets the y- axis at R, calculate the distance TR, to three
significant figures   (2 marks)

5. 1999 Q 7 P2

The equation of a line is

$$-\frac{3}{5}x + 3y = 6$$

Find the:

(a)   Gradient of the line   (1 mark)

(b)   Equation of a line passing through point $(1, 2)$ and
perpendicular to the given line.   (3 marks)

6. 2000 Q 1 P2

Find equation of the perpendicular to the line $x + 2y – 4$ and passes
through point $(2,1)$ (3 marks)

7. 2001 Q 5 P1

A line L_1 passes though point $(1, 2)$ and has a gradient of 5. Another line
L_2, is   perpendicular to L_1 and meets it at a point where $x = 4$. Find the
equation for L_2 in the form of $y = mx + c$ (4 marks)

8. 2003 Q 4 P2

A straight line passes through points A $(-3, 8)$ and B $(3, -4)$.Find the
equation of the straight line through$(3,4)$ and parallel to AB. Give the
answer in the form $y – mx +c$, and c are constants.   (3 marks)

9. 2004 Q 16 P1

P$(5,-4)$and Q $(-1,-2)$ are points on a straight line. Find the equation of the
perpendicular bisector of PQ: giving the answer in the form $y = mx+c$.

(4 marks)

10. 2005 Q 11 P1

On the diagram below, the line whose equation is $7y – 3x + 30 = 0$ passes
through the   points A and B. Point A on the x- axis while point B is
equidistant from x- and y – axes.
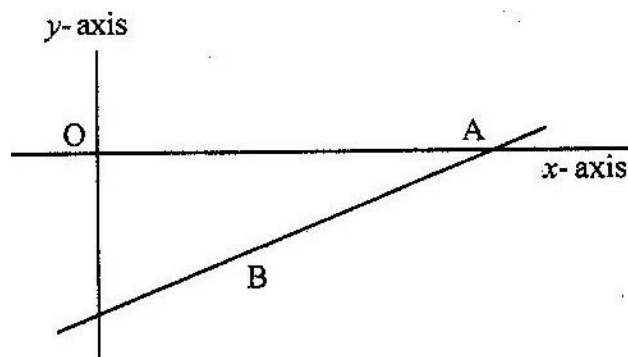
Calculate the co-ordinates of the points A and B   (3 marks)

11. 2005 Q 12 P2

Two lines L_1 and L_2 intersect at a point P. L_1 passes through the points (-4, 0) and (0, 6). Given that L_2 has the equation: $y = 2x – 2$, find, by calculation, the coordinates of P.   (3 marks)

12. 2006 Q 9 P1

A line with gradient of -3 passes through the points (3. k) and (k.8). Find the value of k and hence express the equation of the line in the form $ax + by = c$, where a, b, and c are constants.   (3 marks)

13. 2007 Q 7 P2

Find the equation of a straight line which is equidistant from the points (2, 3) and (6, 1), expressing it in the form $ax + by = c$ where a, b and c are constants   (4 marks)

14. 2008 Q 11 P1

Three vertices of a rhombus ABCD are; A(-4,-3), B(1,-1) and C(3,4) are constants.

                    (2 marks)
a) Draw the rhombus on the grid provided below.   (2 marks)
b) Find the equation of the line AD in the form $y = mx + c$, where and c are constants.   (2 marks)

15. 2008 Q 15 P1

The equation of line L_1 is $2y-5x-8=0$ and line L_2 passes through the points (-5, 0) and (5,-4). Without drawing the lines L_1 and L_2 show that the two lines are perpendicular to each other.   (3 marks)

16. 2009 Q 9 P1

A line which joins the points A (3,k) and B (-2,5) is parallel to another line whose equation is $5y +2x = 10$ .Find the value of k.   (3 marks)

17. 2009 Q 14 P1

The diagonals of a rhombus PQRS intersect at T. Given that P(2,2),Q(3,6) and (-1,5):

(a) Draw the rhombus PQRS on the grid provided;

(b) State the coordinate of T.   (2 marks)

18. 2010 Q 3 P1

A straight line *l* passes through the point (3,-2) and is perpendicular to a line whose equation is *2y – 4x* =1. Find the equation of **/** in the form y= mx + c, where m and c are constants.   (3 marks)

19. 2011 Q 12 P1

Three vertices of a parallelogram PQRS are P(-1, -2),Q(8,-5)and R(5,0).

a) On the grid provided below draw the parallelogram PQRS   (1 mark)

b) Determine the length of the diagonal QS.   (2 marks)

20. 2012 Q13 P1

A line *L* passes through point (3, 1) and is perpendicular to the line 2y = 4*x* + 5.
Determine the equation of line *L.*   (3 marks)

21. 2013 Q12 P1

A straight line passes through points (-2, 1) and (6, 3).
Find:

a)   equation of the line in the form y = mx + c;   (2 marks)

b)   the gradient of a line perpendicular to the line in (a)   (1 mark)

22. 2014 Q17 P1

A line L passes through (-2, 3) and (-1, 6) and is perpendicular to a line P at (-1, 6).

(a) Find the equation of L   (2marks)

(b) Find the equation of P in the form *ax + by = c,* where a, b and c are constants.   (2marks)

(c) Given that another line Q is parallel to L and passes through point (1, 2) find the x and y intercepts of Q   (3marks)

(d) Find the point of the intersection of lines P and Q   (3marks)

23. 2015 Q21 P1

(a) A straight line L, whose equation is $3y - 2x = -2$ meets the x-axis at R.
Determine the co-ordinates of R.   (2 marks)

(b) A second line L_2 is perpendicular to L_1 at R. Find the equation of L_2 in
the form $y = mx + c$, where m and c are constants.   (3 marks)

(c)   A third line L_3 passes through $(-4,1)$ and is parallel to L_2 Find:
   (i)   the equation of L_3 in the form $y = mx + c$, where m and c are constants
                                                                   (2 marks)
   (ii) the co-ordinates of point S, at which L intersects L   (3 marks)

24. 2016 Q11 P1

A line with gradient of -3 passes through the points (3 , k) and (k, 8).

Find the value of k and hence express the equation of the line in the

form $ax + by = c$, where a, b and c are constant   (3 marks)

TRANSFORMATIONS

REFLECTION, ROTATION, TRANSLATION, ENLARGMENT

1. **1989 Q22 P2**
   (a) O n the grid provided, draw a square (s) with vertices (6, 3), (7, 0) (9, 4)
   and (10, 1).Draw also two straight lines AB and AC where the coordinates
   of A, B and C are (1,-2), (3, 2) and (0, 1) respectively.

   S′ is the image of S under reflection in the line AB and S″ is the image of S′
   under refection in the line AC. Draw S′ and S″   (5 marks)

   (b) Describe the transformation which maps S onto S″ if the transformation is
       (ii)   translation   (1 mark)
       (iii)   rotation   (2 marks)

2. **1991 Q7 P2**
   The image of P (0, 2), under an enlargement with a scale factor 3 is P′ (4, 6).
   Find the centre of enlargement   (3 marks)

3. 1991 Q15 P2

In the figure below A'B' is the image of AB under rotation. Use geometrical
instruments to locate the centre of rotation for the figure   (3 marks)
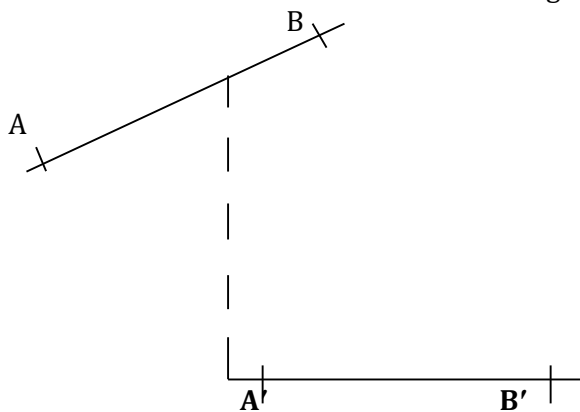
4. 1992 Q3 P1

The points A' (3, 2) and B' (4,-1) are the images of A and B respectively under
a translation.

Given that he coordinates of A are (0, 1) find the coordinates of B.

(3 marks)

5. 1995 Q6 P2

A translation maps a point (1, 2) onto) (-1, 2). What would be the coordinates
of the object whose image is (-3 , -3) under the same   translation?   (2 marks)

6. 1999 Q2 P1

A point (-5, 4) is mapped onto (-1, -1) by a translation. Find the image of
(-4, 5) under the same translation.   (3 marks)

7. 1999 Q11 P2

In the figure below triangle ABO represents a part of a school badge.   The badge
has as symmetry of order 4 about O. Complete the figures to show the badge.

(3 marks)
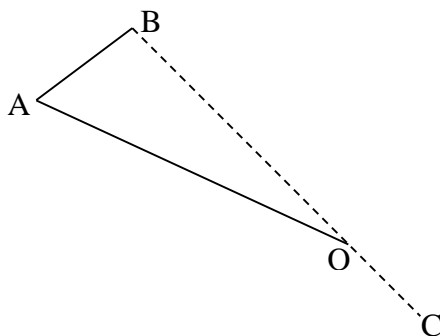
8. **2000 Q9 P2**

   A triangle is formed by the coordinates A (2, 1) B (4,1) and C(1,6). It is rotated clockwise through 90^0 about the origin. Find the coordinates of this image.

   (3 marks)

9. **2001 Q7 P2**

   A translation maps a point P (3, 2) onto P' (5,-4)

   a) Determine the translation vector. (1 marks)

   b) A point Q' is the image of the point (2, 5) under the same translation. Find the length of P'Q', leaving the answer in surd form. (2 marks)

10. **2003 Q7 P2**

    In the figure below, triangle A ′B′ C′ is the image of triangle ABC under a rotation, centre O.
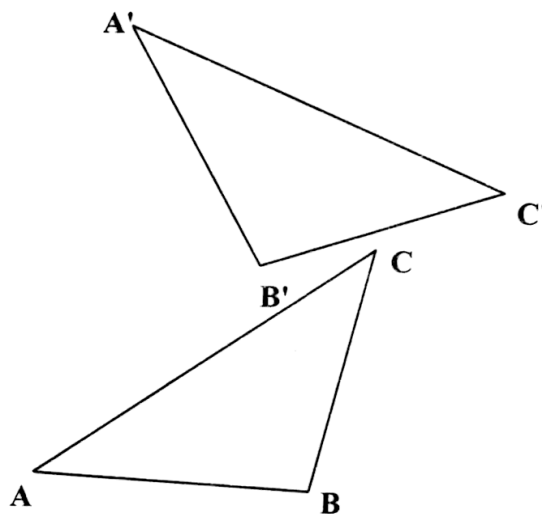
    By construction, find the label the centre O of the rotation. Hence, determine the angle of the rotation. (3 marks)

11. **2005 Q4 P2**

The diagram below is a part of a figure which has rotational symmetry of order 4 about O.
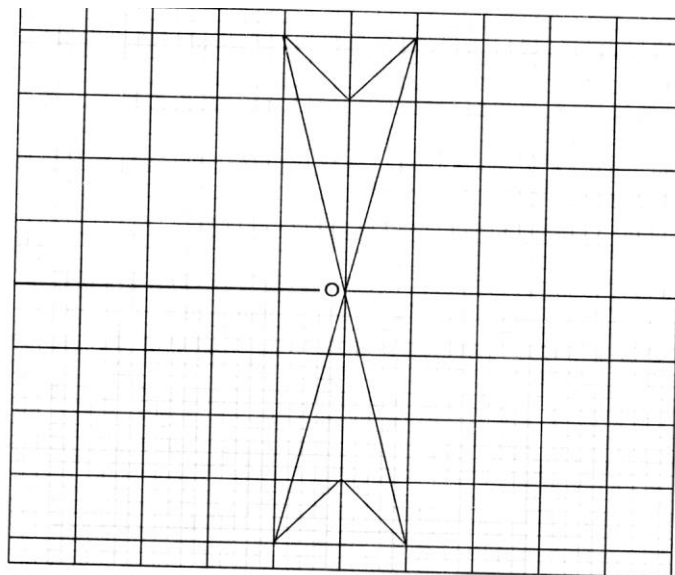
(a)   Complete the figure   (1 mark)

(b)   Draw all the lines of symmetry of the completed figure   (2 marks)

12. **2006 Q18 P1**

On the Cartesian plane below, triangle PQR has vertices P(2, 3), Q (1,2) and R (4,1) while triangles P ″Q ″ R″ has vertices P″ (-2, 3), Q ″ (-1,2) and R ″ (-4, 1)
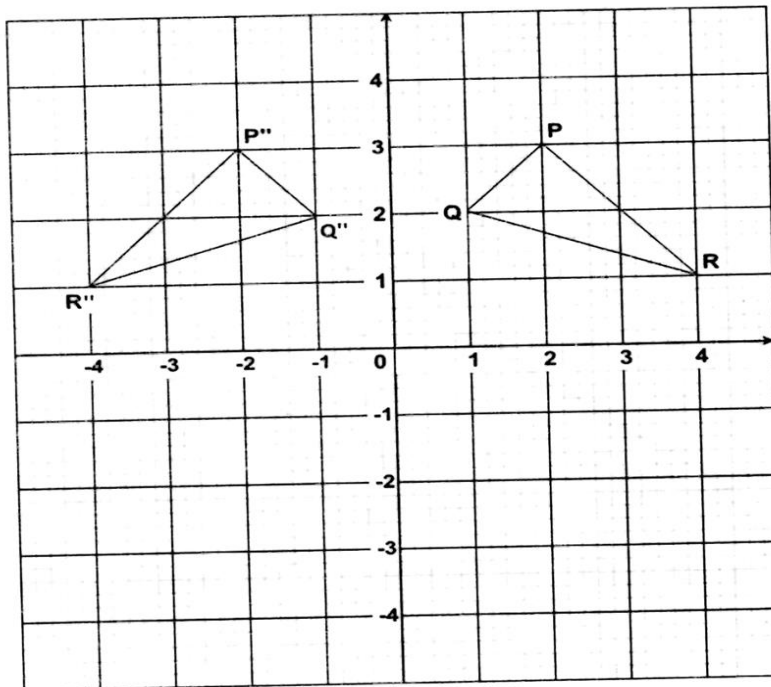
(a) Describe fully a single transformation which maps triangle PQR onto
triangle P ″Q ″ R″   (2 marks)
(b) On the same plane, draw triangle P′Q′R′, the image of triangle PQR, under
reflection in line $y = -x$ (2 marks)
(c) Describe fully a single transformation which maps triangle P′Q′R′, onto
triangle P″ Q ″ R″   (2 marks)

(d) Draw triangle P ‴Q″′ R″′ such that it can be mapped onto triangle
PQR by a positive quarter turn about (0,0)   (2 marks)
(e) State all pairs of triangle that are oppositely congruent   (2 marks)

13. **2008 Q21 P1**
The diagram below shows a triangle ABC with A (3, 4), B (1, 3) and C (2, 1).
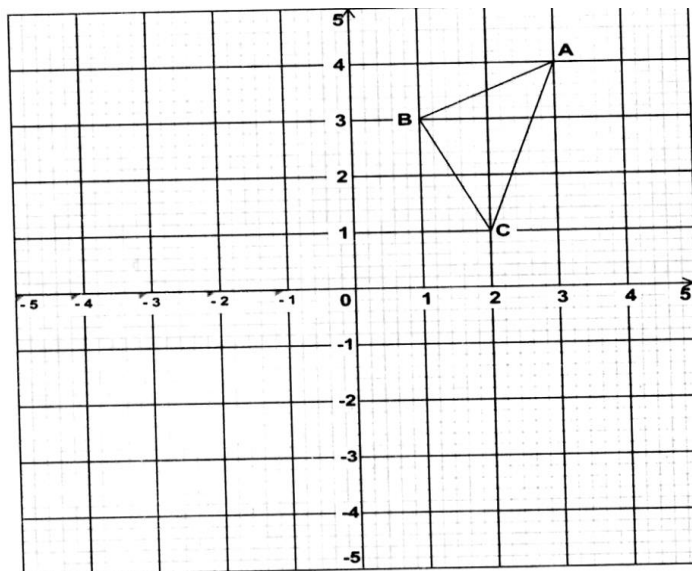
a) Draw △A′B′C′ the image of ABC under a rotation of +90⁰ about (0, 0).

(2 marks)

b) Draw △ A″B″C ″ the image of A′B′C′under a reflection in the line y=x.

(2 marks)

c) Draw △ A‴B‴C‴′ the image of Δ A″B″C″ under a rotation of -90⁰ about
(0, 0)   (2 marks)

d) Describe a single transformation that maps △ABC onto △ A‴B‴C‴

(2 marks)

e) Write down the equations of the lines of symmetry of the quadrilateral
BB″A‴A′   (2 marks)

14.   2010 Q22 P1

In the figure below, ABCD is a square .Points P, Q, R and S are the midpoints of
AB, BC, CD and DA respectively.
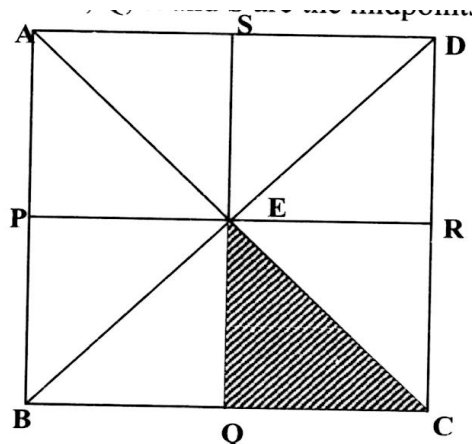
(a). Describe fully:

    (i)   a reflection that maps triangle QCE onto triangle SDE.   (1 mark)

    (ii)   an enlargement that maps triangle QCE onto triangle SAE.

                                                     (2 marks)

    (iii)   a rotation that maps triangle QCE onto triangle SED.   (3 marks)

(b). The triangle ERC is reflected on the line BD. The image of ERC
    under the reflection is rotated clockwise through an angle of 90^0 about P.

    Determine the images of R and C:

    (i)   Under the reflection   (2 marks)

    (ii)   After two successive transformations   (2 marks)

15. 2011 Q7 P2

The vertices of a triangle are A (1,2), B(3, 5) and C(4, 1).The coordinates of
C' the image of C under a translation vector T, are (6, -2).

(a) Determine the translation vector T.   (1 mark)

(b) Find the coordinates of A' and B' under translation vector T.   (2 marks)

16. 2012 Q21 P1

The vertices of quadrilateral OPQR are O(0,0), P(2,0), Q(4,2) and R(0,3). The
vertices of its image under a rotation are O'(1, -1), P'(1, -3) Q'(3, -5) an R'(4, -1).

(a) (i) On the grid provided, draw OPQR and its image O'P'Q'R'   (2 marks)

      (ii) By construction, determine the centre and angle of rotation.   (3 marks)

(b) On the same grid as (a) (i) above, draw O''P''Q''R'', the image of O'P'Q'R'
    under a reflection in the line $y = x$ (2 marks)

(c) From the quadrilaterals drawn, state the pairs that are:

(i)   Directly congruent;   (2 marks)

(ii) Oppositely congruent   (2 marks)

17. 2013 Q23 P1

(a) On the grid provided, draw the square whose verticals are A (6, -2),
B (7, -2), C (7, -1) and D (6, -1).   (1 mark)

(b) On the same grid, draw:

(i) A B'C'D', the image of ABCD, under an enlargement scale factor 3,
centre(9, -4);   (3 marks)

(ii) A''B''C''D'', the image of A'B'C'D', under a reflection in the line x = 0;

(2 marks)

(iii) A'''B'''C'''D''', the image of A''B''C''D'' under a rotation of $+ 90^0$
about (0,0)

(2 marks)

(c) Describe a single transformation that maps A'B'C'D' onto A'''B'''C'''D'''

(2 marks)

18. 2014 Q16 P1

Points A (-2, 2) and B (-3, 7) are mapped onto A' (4, -10) and B' (0, 10) by an
enlargement.

Find the scale factor of the enlargement.   (3marks)

19. 2015 Q22 P1

On the grid below, an object T and its image T' are drawn
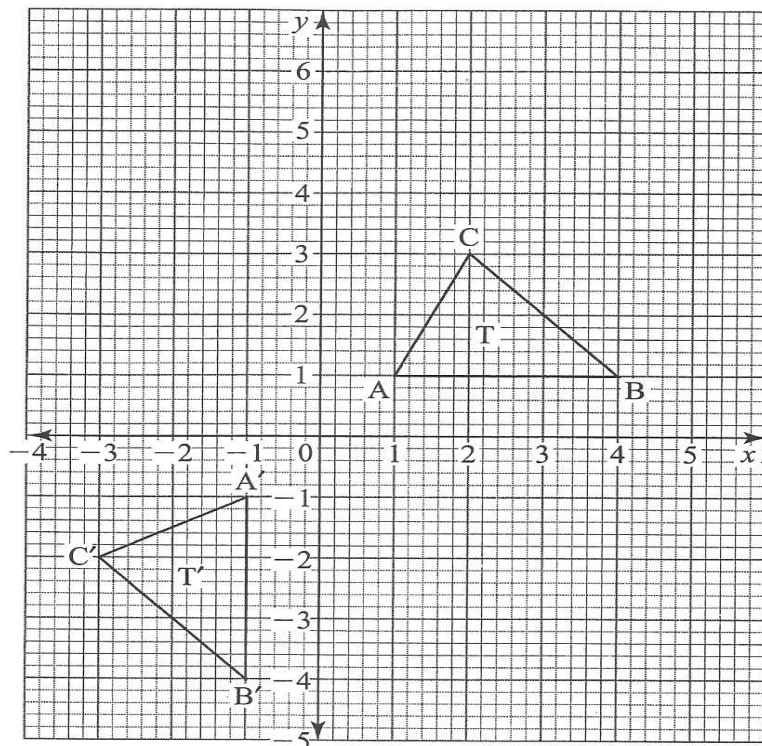
a) Find the equation of the mirror lien that maps T onto T'. (1 mark)

b i)T' is mapped onto T" by positive quarter turn about (0,0). Draw T" (2 marks)

ii) Describe a single transformation that maps T onto T" (2 marks)

c) T" is mapped onto T"' by an enlargement, centre (2,0), scale factor -2 .
Draw T"' (2 marks)

d) Given that he area of T"' is 12cm², calculate the area of T"' . (3 marks)

SIMILARITY AND CONGRUENCY

1. **1989 Q15 P2**

   In the figure below, **ABCD** IS A cyclic quadrilateral and BC is parallel to AD.
   Show that triangle ABX is congruent to triangle DXC. (4 marks)
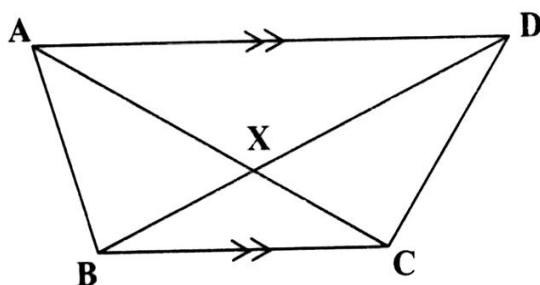
2. **1990 Q7 P2**

   In the triangle ABC shown below DE is parallel to BC. If AE = 3cm and EC = 2cm,
   determine the ratio of the triangle ADE to that of the triangle ABC. (2 marks)
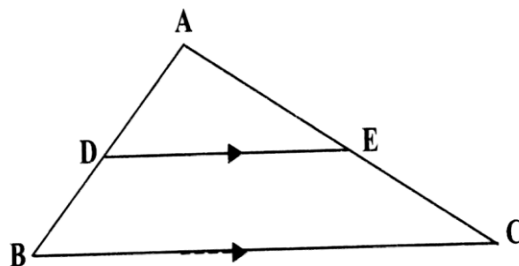
3. **1991 Q6 P1**

   In the figure below AD // BC. AC and BD intersect at E. Given that AE: EC = 1:5
   and BD =12 cm, calculate the length of DE. (3 marks)
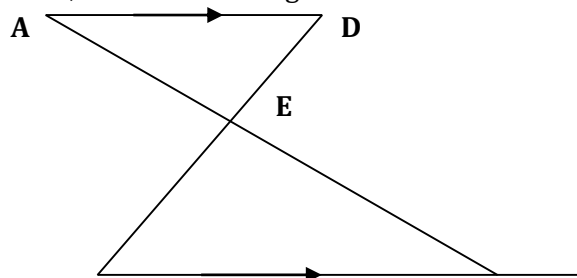
4. 1992 Q5 P1

In the figure above, triangle ABC is similar to triangle AED and BC // ED. Given that the ratio AB: AE = 2:5, find the ratio of the area of triangle ABC to that of the trapezium BCDE.

(3 marks)
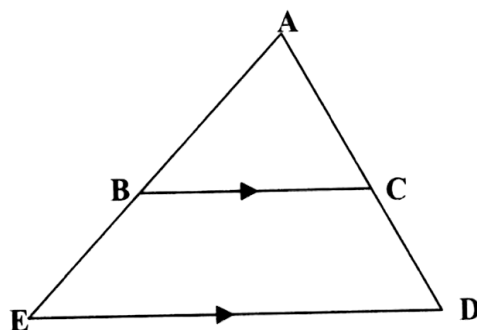
5. 1992 Q21 P1

In the figure given below (not drawn to scale) DC is a tangent to the circle centre O. AOBC is a straight line.
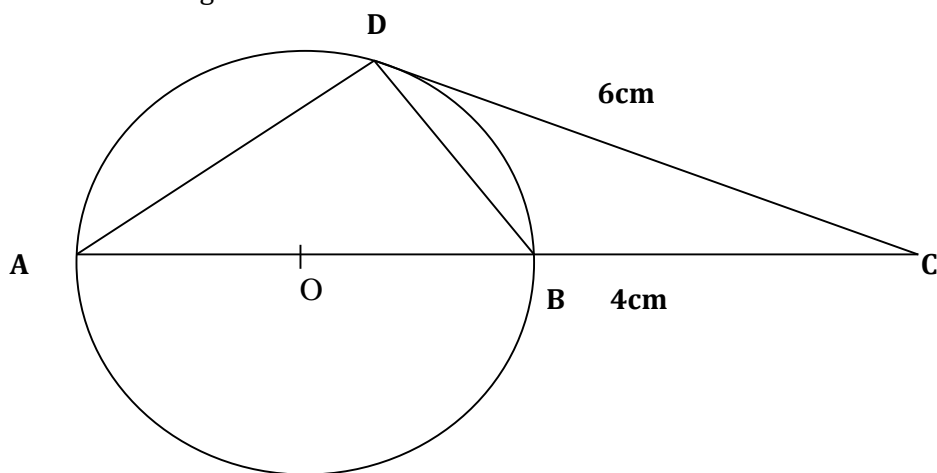
(a) Show that ΔADC is similar to Δ DBC.
(b) Given that BC = 4cm AND DC = 6cm, calculate
  (i)   the length of AB   (3 marks)
  (ii)   the size of angle ACD   (2 marks)

6.   1992 Q15 P2

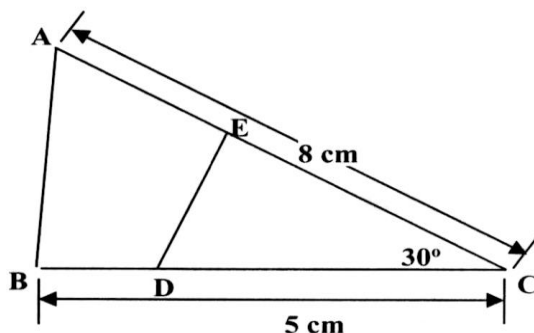In the figure below, the chord AB and CD intersect at E. Show that ∆AED is similar to ∆BEC. (3 marks)
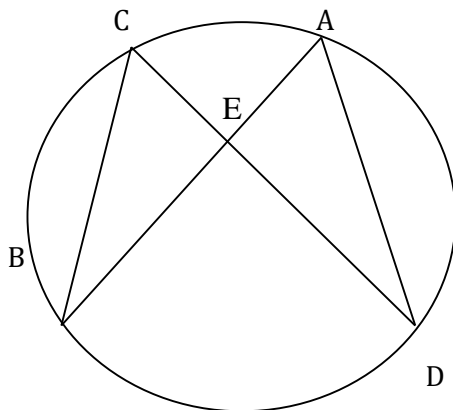
7.   1993 Q16 P1

In the triangle ABC below AC=8cm, BC=5cm and angle BCA = 30^0. Point D divides BC in the ratio 1:4 and point E divides AC in the ratio 2:3. Find the area of the quadrilateral ABDE (3 marks)

8.   1993 Q2 P2

A football tube in the form of a sphere is inflated so that its radius increases in the ratio of 4:3. Find the ratio in which the volume is increased (2 marks)

9. 1994 Q9 P9

A container of height 30cm has a capacity of 1.5 litres. What is the height of a similar container of capacity 3.0 m^3? (3 marks)

10. 1995 Q7 P2

The ratio of the lengths of the corresponding sides of two similar rectangular water tanks is 3:5. The volume of the smaller tank is 8.1 m^3. Calculate the volume of the larger tank. (3 marks)
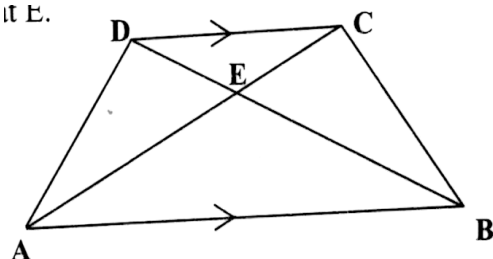
11. 1996 Q10 P2

Pieces of soap are packed in a cuboid container measuring 36cm by 24cm by 18cm. Each piece of soap is similar to the container. If the linear scale factor between the container and the soap is $1/6$, find the volume of each piece of soap.

(2 marks)

12. 2002 Q15 P2

In the diagram below, ABCD is a trapezium with AB parallel to DC. The diagonals AC and BD intersect at E.

a) Giving reasons show that triangle ABE is similar to triangle CDE.　　(2 marks)
b) Giving that AB = 3DC, find the ratio of DB to EB.　　(2 marks)

13. 2005 Q8 P2

The volumes of two similar solid cylinders are 4752 cm³ and 1408 cm³. If the area of the curved surface of the smaller cylinder is 352 cm², find the area of the curved surface of the larger cylinder.　　(4 marks)

14. 2008 Q9 P2

In the figure below, angles BAC and ADC are equal. Angle ACD is a right angle. The ratio of the sides AC: BC = 4:3
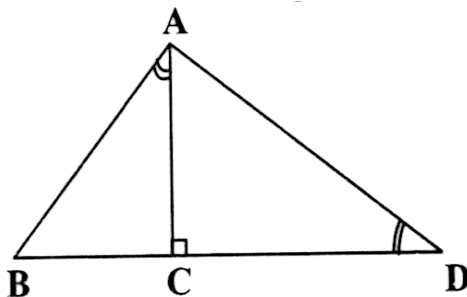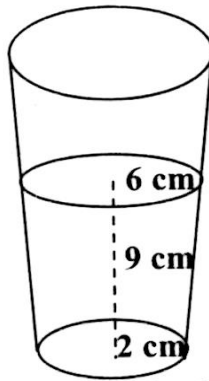

Given that the area of triangle ABC is 24cm²,find the area of triangle ACD

(4 marks)

15. 2009 Q21 P1

A glass in the form of a frustum of a cone is represented by the   diagram below. The glass contains water to a height of 9 cm. The bottom of the glass is a circle of radius 2 cm while the surface of the water is a circle of radius 6 cm.

(a) Calculate the volume of the water in the glass.   (3 marks)

(b) When a special marble is submerged into the water in the glass, the water
     level rises by 1 cm.
   Calculate :
    (i) the volume of the marble   (4 marks)
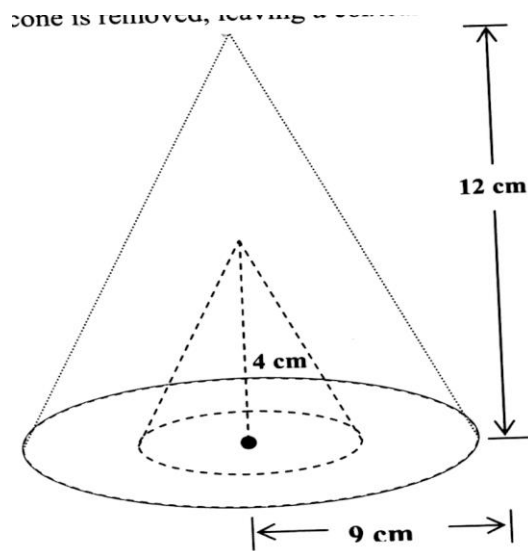   (ii) the radius of the marble   (3 marks)

16. 2011 Q 16 P1

A small cone of height 8 cm is cut off from a bigger cone to leave a frustum
of height 16cm. If the volume of the smaller cone is 160cm^3, find the volume
of the frustum   (3 marks)

17. 2013 Q24 P1

The figure below represents a cone of height 12 cm and base radius of 9 cm
from which a similar smaller cone is removed, leaving a conical hole of height 4 cm.

cone is removed, leaving a ......

a) Calculate:

   i.   The base radius of the conical hole;   (2 marks)

   ii.   The volume, in terms of π, of the smaller cone that was removed . (2 marks)

b) (i) Determine the slant height of the original cone.   (1 mark)

18. 2016 Q14 P1

A small cone of height 8cm is cut off from a bigger cone to leave a frustum of

height 16cm. If. the volume of the smaller cone is 160cm³, find the volume of

the frustum.   (3 marks)

TRIGONOMETRY

1. **1989 Q4 P1**

   When the angle of elevation of the sun is 58^0, a vertical pole casts a shadow
   of length 5m on a horizontal ground. Find the height of the pole   (2 marks)

2. **1990 Q12 P1**

   The angle of elevation of the top of a cliff from point P is 45^0. From a point Q
   which is 10m from P towards the foot of the cliff, the angle of elevation is 48^0.
   Calculate the height of the cliff.   (4 marks)

3. **1990 Q12 P2**

Towns A,B,C and D are such that A is 15km north of B,C is 8km east of B,D
is directly east of A and on a bearing 060^0 from C. Find the distance between
towns A and d, giving your answer to two significant figures (3 marks)

4. **1994 Q23 P2**

A flag 10m long is fixed on top of a tower. From a point on horizontal
ground, the angles of elevation of the top and bottom of the flag post are
40^0 and 33^0 respectively.

Calculate

(a) The height of the tower (6 marks)

(b) The shortest distance from the point on the ground to the top of
the flag post

(2 marks)

5. **1996 Q4 P1**

A man walks directly from point A towards the foot of a tall building 240m away.
After covering 180m, he observes that the angle of the top of the building is 45^0.
Determine the angle of elevation of the top of the building from A.

(3 marks)

6. **1997 Q5 P1**

There are two signposts A and B on the edge of the road. A is 400 m to the west
of b. A tree is on a bearing of 060^0 from A and a bearing of 330^0 from B

Calculate the shortest distance of the tree from the edge of the road.
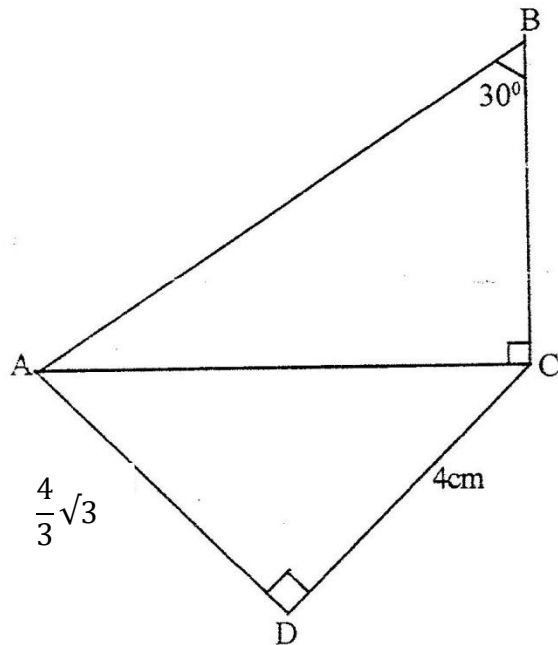
(3 marks)

7. **1998 Q6 P1**

A point A is directly below a window. Another point B is 15 m from A
and at the same horizontal level. From B angle of elevation of the top of the
bottom of the window is 30^0 and the angle of elevation of the top of the window
is 35^0.

Calculate the vertical distance.

(a) From A to the top of the window (1 mark)

(b) From A to the bottom of the window (1 mark)

(c) From the bottom to top of the window (1 mark)

8. 1998 Q4 P2

In the figure below ABC = 30⁰, < ACB = <ADC= 90⁰, AD = $\frac{4}{3}\sqrt{3}$ cm and DC = 4cm

Calculate the length of (a) AC (2 marks)
(b) BC (2 marks)

9. 2000 Q7 P1

Given that sin θ = $^2/_3$ and θ is an acute angle find:
(a) Tan θ giving your answer in surd form (2 marks)

10. 2001 Q20 P2

An electric pylon is 30m high. A point S on top of the pylon is vertically   above another point on the ground . Points A and B are on the same horizontal ground as R. Point A is due south of the pylon and the angle of elevation of S from A is 26⁰. Point B is due west of the pylon and the angle of elevation of S from B is 32⁰.

a) Distance from A and B (6 marks)
b) Bearing B from A (2 marks)

11. 2003 Q12 P1

Two straight paths are perpendicular to each other at point p. One path meets a straight road at point A while the other meets the same road at B. Given that PA is 50 metres while PB is 60 metres. Calculate the obtuse angle

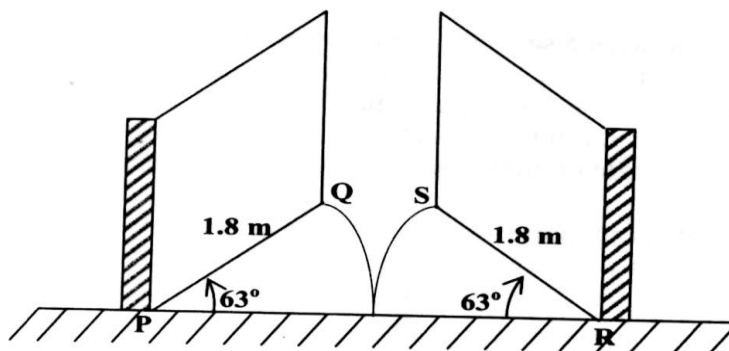made by path PB and the road. (3 marks)

12. 2005 Q7 P1

Given that sin $(90 - x)^0 = 0.8$, where x is an acute angle, find without using mathematical tables the value of tan x^0. (2 marks)

13. 2006 Q11 P1

The diagram below represents a school gate with double shutters. The shutters are such opened through an angle of 63^0.
The edges of the gate, PQ and RS are each 1.8 m

Calculate the shortest distance QS, correct to 4 significant figures
(3 marks)

14. 2007 Q8 P1

Given that x is an acute angle and $\cos x = \dfrac{2\sqrt{5}}{5}$ cos x = , find without using mathematical tables or a calculator, tan $(90 - x)^0$. (2 marks)

15. 2007 Q15 P1

Points L and M are equidistant from another point K. The bearing of L from K is 330^0. The bearing of M from K is 220^0. Calculate the bearing of M from L (3 marks)

16. 2007 Q18 P1

In the diagram below PA represents an electricity post of height 9.6 m. QB and RC represents two storey buildings of heights 15.4 m and 33.4 m respectively. The angle of depression of A from B is 5.5^0 While the angle of elevation of C from B is 30.5^0 and BC = 35m.
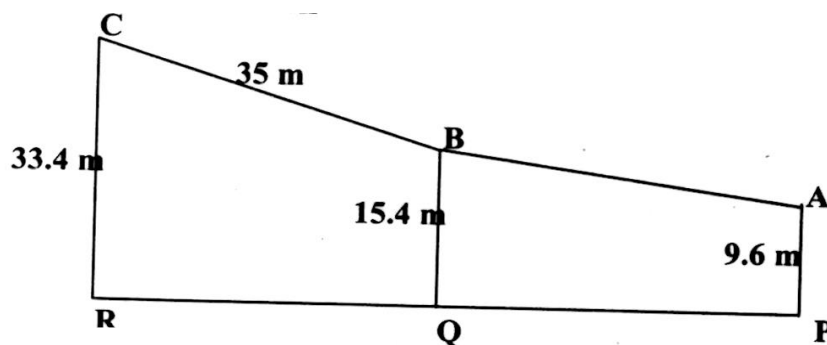
(a) Calculate, to the nearest metre, the distance AB   (2 marks)

(b) By scale drawing find,

    (i) The distance AC in metres   (5 marks)

    (ii) $\angle$ BCA and hence determine the angle of depression of A from C

(3 marks)

17. 2008 Q20 P1

The diagram below represents two vertical watch-towers AB and CD on a level ground. P and Q are two points on a straight road BD. The height of the tower AB is 20m road a BD is 200m.
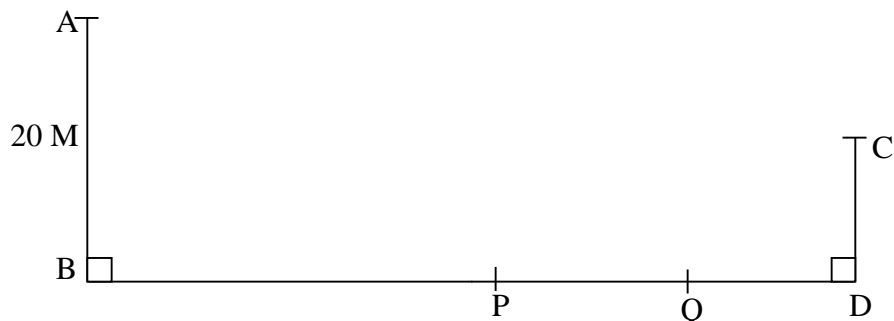
a)   A car moves from B towards D. At point P, the angle of depression of the car from point A is 11.3^0. Calculate the distance BP to 4 significant figures.

(2 marks)

b)   If the car takes 5 seconds to move from P to Q at an average speed

of 36 km/h, calculate the angle of depression of Q from A to 2
decimal places   (3 marks)

  c) Given that QC=50.9m, calculate;
      (i) The height of CD in meters to 2 decimal places;   (2 marks)
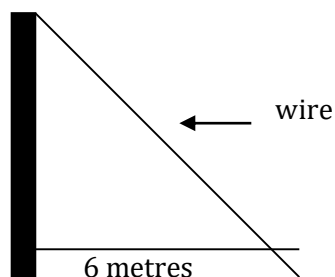   (ii) The angle of elevation of A from C to the nearest degree.   (3 marks)

18. 2009 Q12 P1
An electric pole is supported to stand vertically on a level ground by a tight wire.
The wire is pegged at a distance of 6 metres from the foot of the pole as shown.

The angle which the wire makes with the ground is three times the angle it
makes with the pole. Calculate the length of the wire to the nearest centimetre.

                                                                                (3 marks)
19. 2010 Q13 P1
Given that $3\theta^0$ is an acute angle and sin $3\theta^0$,find the value of θ.   (3 marks)

20. 2011 Q5 P1
Given that sin $(x + 60)^0$ = cos $(2x)$, find tan $(x + 60)^0$ (3 marks)

21. 2012 Q10 P1
Given that tan $x^0 = \frac{3}{7}$, find the cos $(90 - x)^0$ giving the answer to 4
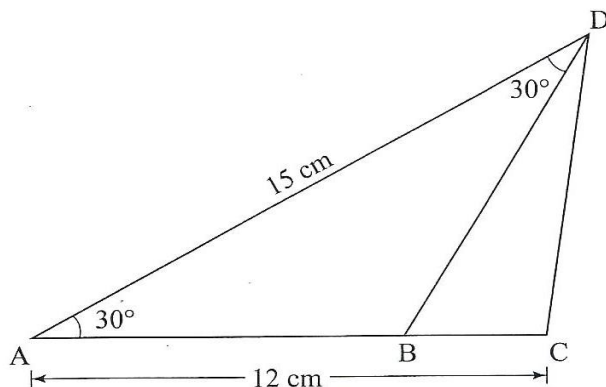Significant figures   (2 marks)

22. 2015 Q5 P1
A piece of wire is bent into the shape of an isosceles triangle. The base angles
are each 48° and the perpendicular height to the base is 6 cm. Calculate,
correct to one decimal place, the length of the wire.   (3 marks)

23. 2015 Q20 P1

In the figure below, AC = 12cm, AD =15 cm and B is point on AC, <BAD= DB=30⁰.

Calculate , correct to one decimal place

a) The length of CD: (3 marks)

b) The length of AB   (3 marks)

c) The area of triangle BCD   (2 marks)

d) The size of <BDC   (2 marks)

24. 2015 Q15 P2

Solve the equation $\sin(\frac{1}{2}x - 30^0) = \cos x$ for $0 < x < 90^0$.   (2 marks)

25. 2016 Q7 P1

Given that x is an acute angle and $\cos x^0 = \frac{2}{5}\sqrt{5}$ find, without using

mathematical tables or a calculator, $\tan(90-x)^0$.   (2 marks)

26. 2016 Q12 P1

A line with gradient of -3 passes through the points (3 , k) and (k, 8). Find

the value of k and hence express the equation of the line in the form

ax + by = c , where a, b and c are constant   (3 marks)