1. The marks obtained by 8 candidates in Physics and Chemistry tests are given below.

Physics (x)	6	8	10	11	10	5	4	12
Chemistry (y)	8	11	14	13	11	7	5	15

(a) Write down the product moment correlation coefficient, r.

(1)

(b) Write down, in the form $y = mx + c$, the equation of the regression line y on x for the 8 candidates.

(2)

A ninth candidate obtained a score of 7 in the Physics test but was absent for the Chemistry test.

(c) Use your answer to (b) to estimate the score he would have obtained on the Chemistry test.

(2)

(d) Give a reason why it is valid to use this regression line to estimate the score on the Chemistry test.

(1)
(Total 6 marks)

2. Tania wishes to see whether there is any correlation between a person's age and the number of objects on a tray which could be remembered after looking at them for a certain time.

She obtains the following table of results.

Age (x years)	15	21	36	40	44	55
Number of objects remembered (y)	17	20	15	16	17	12

(a) Use your graphic display calculator to find the equation of the regression line of y on x.

(2)

(b) Use your equation to estimate the number of objects remembered by a person aged 28 years.

(1)

(c) Use your graphic display calculator to find the correlation coefficient r.

(1)

(d) Comment on your value for r.

(2)
(Total 6 marks)

3. The quadrilateral ABCD shown below represents a sandbox. AB and BC have the same length. AD is 9 m long and CD is 4.2 m long. Angles AD̂C and AB̂C are 95° and 130° respectively.
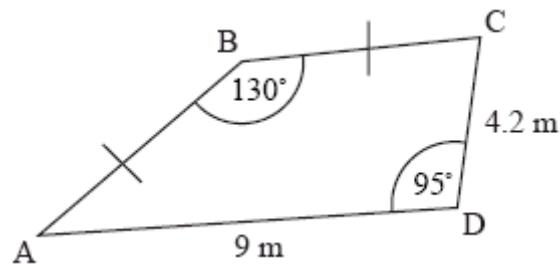

diagram not to scale

(a) Find the length of AC.

(3)

(b) (i) Write down the size of angle BĈA.

(ii) Calculate the length of AB.

(4)

(c) Show that the area of the sandbox is 31.1 m^2 correct to 3 s.f.

(4)

The sandbox is a prism. Its edges are 40 cm high. The sand occupies one third of the volume of the sandbox.

(d) Calculate the volume of sand in the sandbox.

(3)
(Total 14 marks)

4. The tuition fees for the first three years of high school are given in the table below.

Year	Tuition fees (in dollars)
1	2000
2	2500
3	3125

These tuition fees form a geometric sequence.

(a) Find the common ratio, r, for this sequence.

(b) If fees continue to rise at the same rate, calculate (to the nearest dollar) the total cost of tuition fees for the first six years of high school.

(Total 4 marks)

5. A geometric progression G_1 has 1 as its first term and 3 as its common ratio.

(a) The sum of the first n terms of G_1 is 29 524. Find n.

(3)

A second geometric progression G_2 has the form 1, $\dfrac{1}{3}$, $\dfrac{1}{9}$, $\dfrac{1}{27}$ ...

(b) State the common ratio for G_2.

(1)

(c) Calculate the sum of the first 10 terms of G_2.

(2)

(d) Explain why the sum of the first 1000 terms of G_2 will give the same answer as the sum of the first 10 terms, when corrected to three significant figures.
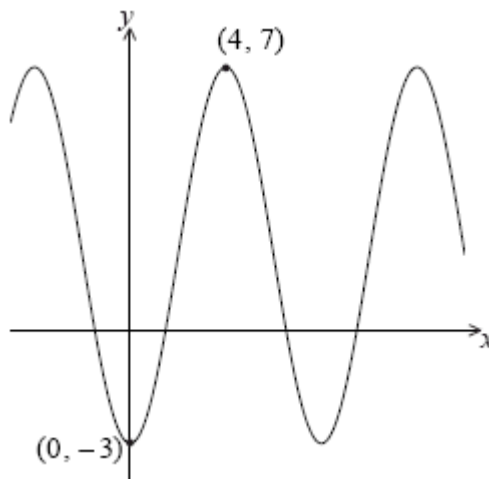
(1)

(e) Using your results from parts (a) to (c), or otherwise, calculate the sum of the first 10 terms of the sequence 2, 3 $\dfrac{1}{3}$, 9 $\dfrac{1}{9}$, 27 $\dfrac{1}{27}$ ...

Give your answer **correct to one decimal place**.

(3)
(Total 10 marks)

6. The graph of $y = p \cos qx + r$, for $-5 \le x \le 14$, is shown below.

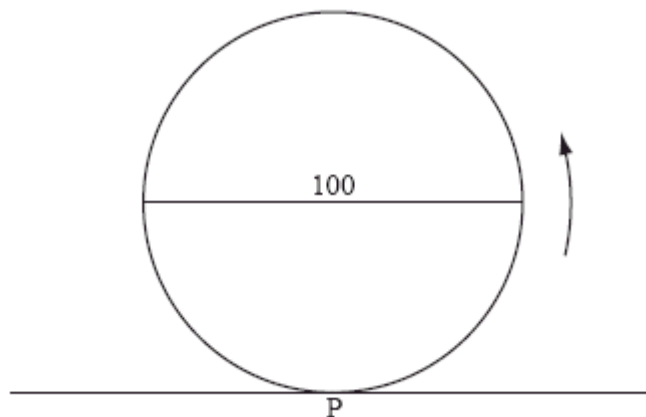There is a minimum point at (0, –3) and a maximum point at (4, 7).

Find the value of

    (i) p;

    (ii) q;

    (iii) r.

(Total 6 marks)

7. The following diagram represents a large Ferris wheel, with a diameter of 100 metres.

Let P be a point on the wheel. The wheel starts with P at the lowest point, at ground level. The wheel rotates at a constant rate, in an anticlockwise (counterclockwise) direction. One revolution takes 20 minutes.

(a) Write down the height of P above ground level after

   (i)   10 minutes;

   (ii) 15 minutes.

(2)

Let $h(t)$ metres be the height of P above ground level after t minutes. Some values of $h(t)$ are given in the table below.

t	$h(t)$
0	0.0
1	2.4
2	9.5
3	20.6
4	34.5
5	50.0

(b) (i)   Show that $h(8) = 90.5$.

   (ii) Find $h(21)$.

(4)

(c) **Sketch** the graph of h, for $0 \leq t \leq 40$.

(3)

(d) Given that h can be expressed in the form $h(t) = a \cos bt + c$, find a, b and c.

(5)
(Total 14 marks)