

1) Factorise and solve each quadratic

a)  $2x^2 - 30x = 0$

b)  $x^2 + 5x - 14 = 0$

c)  $2x^2 - x - 15 = 0$

2) Write  $3x^2 + 6x + 10$  in the form  $a(x - h)^2 + k$ . Give the minimum value.

3) Find the value of  $m$  for which the quadratic equation  $mx^2 - 4x + 2m = 0$  has equal roots

4) Michele invested 1500 euros at an annual rate of interest of 5.25%, compounded annually.

a) Find the value of Michele's investment after 3 years. Give your answer to the nearest euro.

b) How many complete years will it take for Michele's initial investment to double in value?

c) What should the interest rate be if Michele's initial investment were to double in value in 10 years?

5) Solve  $\log_{27} x = 1 - \log_{27}(x - 0.4)$

6) Solve  $5^{4x} = 6e^x$ . Write the solution in exact form

7) Solve the equation  $4^{3x-1} = 64$

8) Give the largest possible domain for each

a)  $f(x) = 8 - x^2 - 10x^3$       b)  $g(x) = \frac{1}{2x^2} - \frac{\sqrt{x-3}}{x+1}$       c)  $h(x) = \frac{\sqrt[3]{x+6}}{\log_3(x+5)}$

9) Two functions  $f, g$  are defined as follows:

$$f : x \rightarrow 3x + 5$$

$$g : x \rightarrow 2(1 - x)$$

Find each

a)  $f^{-1}(2)$

b)  $(g \circ f)(-4)$

10) For the given geometric sequence, complete the following:

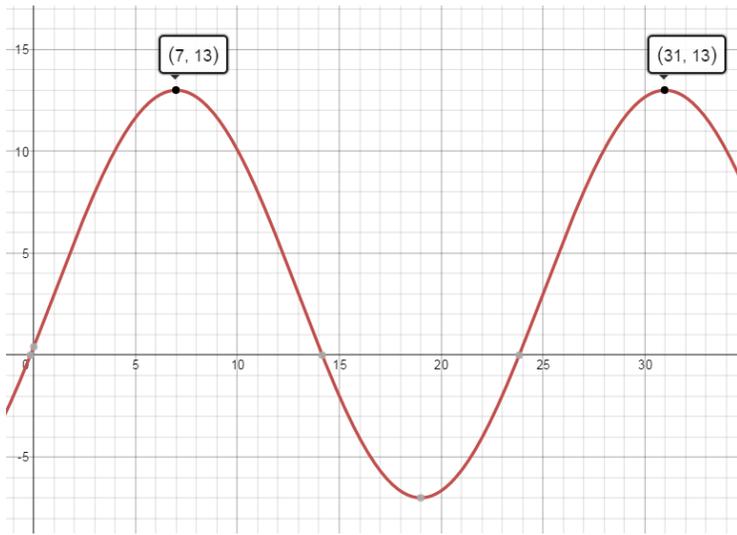
$$\frac{2}{3} - \frac{4}{9} + \frac{8}{27} - \frac{16}{81} + \dots$$

a) Identify the ratio

b) Find the 5<sup>th</sup> term

c) Calculate the sum for the infinite series

11) Write a sine function for the graph below in the form  $f(x) = A \sin B(x - 1) + C$



12) (a) Factorise the expression  $3 \sin^2 x - 11 \sin x + 6$

(b) Consider the equation  $3 \sin^2 x - 11 \sin x + 6 = 0$

(i) Find the two values of  $\sin x$  which satisfy the equation

(ii) Solve the equation for  $0 \leq x \leq 180^\circ$

13) In the triangle PQR, PR = 5 cm, QR = 4 cm and PQ = 6 cm  
Calculate

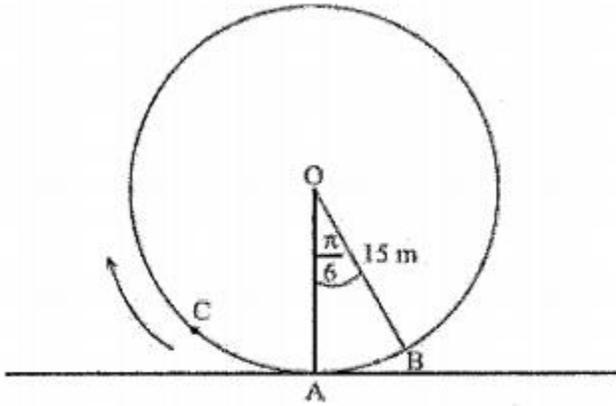
(a) The size of  $\hat{PQR}$ ;

(b) The area of triangle PQR

14)

A Ferris wheel with centre O and a radius of 15 metres is represented in the diagram below.

Initially seat A is at ground level. The next seat is B, where  $\angle AOB = \frac{\pi}{6}$ .



- (a) Find the length of the arc AB.
- (b) Find the area of the sector AOB.

15) Given the sequence 3, 6, 12, 24, ...

- (a) Is the sequence arithmetic or geometric?
- (b) Find the value of  $r$
- (c) Calculate the 20<sup>th</sup> term
- (d) Find the sum of the first 10 terms
- (e) Write a formula for the sum of the first 10 terms in sigma notation

16) It is claimed that the masses of a population of lions are normally distributed with a mean mass of 310 kg and a standard deviation of 30 kg.

(a) Draw a normal curve and label 3 standard deviations in each direction.

(b) What masses give the middle 95% of all lions?

(c) Calculate the probability that a lion selected a random will have a mass of 350 kg or more.

(d) Calculate the probability that a lion selected a random will have a mass between 295 kg and 400 kg.

(e) How much does a lion have to weigh to be in the top 20% of all lions?

17) Suppose the probability one of Mr. Stevens' cats has no tail is 0.45. Suppose he has 80 cats in his basement. Calculate each probability

(a) The probability that exactly 10 cats do not have a tail

(b) The probability that at least 20 cats do not have a tail

(c) The probability that fewer than 50 cats DO have a tail

18)

The number of hours of sleep of 21 students are shown in the frequency table below.

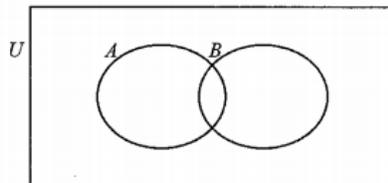
Hours of sleep	Number of students
4	2
5	5
6	4
7	3
8	4
10	2
12	1

Find each

- (a) The median
- (b) The lower quartile
- (c) The interquartile range
- (d) The mean
- (e) The standard deviation

19)

The following Venn diagram shows a sample space  $U$  and events  $A$  and  $B$ .



$n(U) = 25$ ,  $n(A) = 11$ ,  $n(B) = 12$  and  $n(A \cup B)' = 5$ .

- (a) On the diagram, shade the region  $(A \cup B)'$ .
- (b) Find
  - (i)  $n(A \cap B)$ ;
  - (ii)  $P(A \cap B)$ .

5. One thousand candidates sit an examination. The distribution of marks is shown in the following grouped frequency table.

Marks	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100
Number of candidates	15	50	100	170	260	220	90	45	30	20

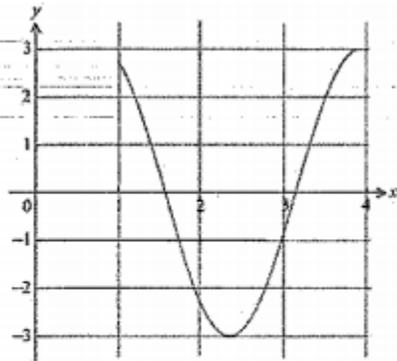
- (a) Copy and complete the following table, which presents the above data as a cumulative frequency distribution.

Mark	$\leq 10$	$\leq 20$	$\leq 30$	$\leq 40$	$\leq 50$	$\leq 60$	$\leq 70$	$\leq 80$	$\leq 90$	$\leq 100$
Number of candidates	15	65					905			

- (b) Calculate the mean and standard deviation for the frequency table using the mid-interval.

20)

Let  $f(x) = 3 \sin 2x$ , for  $1 \leq x \leq 4$  and  $g(x) = -5x^2 + 27x - 35$  for  $1 \leq x \leq 4$ . The graph of  $f$  is shown below.



- (a) On the same diagram, sketch the graph of  $g$ .
- (b) One solution of  $f(x) = g(x)$  is 1.89. Write down the other solution.
- (c) Let  $h(x) = g(x) - f(x)$ . Given that  $h(x) > 0$  for  $p < x < q$ , write down the value of  $p$  and of  $q$ .

Find the exact values for the following angles:

(a)  $\cos \frac{5\pi}{4}$

(b)  $\sin -210^\circ$

(c)  $\cos -\frac{2\pi}{3}$

(d)  $\tan -630^\circ$

(e)  $\frac{\cos \frac{3\pi}{4}}{\sin\left(-\frac{\pi}{6}\right)}$