Constructing Formulae

1. The cost of a holiday at an outdoor centre depends on the time of year the holiday is taken and the number of nights staying at the centre.
   The table below show these costs.

Time of Year	Cost
High Season 1st May – 30th Sep	£220 for 5 nights **and** £35 for each extra night
Mid Season 16th Mar – 30th Apr **or** 1st Oct – 15th Nov	£170 for 5 nights **and** £30 for each extra night
Low Season 16th Nov – 15th Mar	£150 for 5 nights **and** £28 for each extra night

   (a) Calculate the cost of staying at the centre for 9 nights beginning on the 4th April.

   (b) Write down a formula for the cost £**C**, of staying at the centre during Mid Season for **n** nights where **n** is greater than 5.

2. The cost of sending a parcel depends on the weight of the parcel and the delivery time.
   The cost is calculated as shown below.

Time of Delivery	Cost
By 10 am the next working day	£16.50 for 10 kg **and** £0.80 for each extra kg
By noon the next working day	£14.50 for 10 kg **and** £0.70 for each extra kg
By 5 pm the next working day	£11.50 for 10 kg **and** £0.50 for each extra kg

   (a) Find the cost of sending a parcel, weighing 16 kg, for delivery by **noon** the next working day.

   (b) Write down a formula for the cost, £**C**, of sending a parcel, of weight **w** kg, where **w** is greater than 10.
       The parcel is to be delivered by **10 am** the next working day.

3. An extract from a camping brochure is shown below.
   The costs are based on **14 nights** at the camp.

Season	Two Adults	Each Extra Adult	Each Child Age 10 - 16	Each Child Age 0 - 9
Low	£360	£100	£60	Free
Mid	£420	£110	£70	Free
High	£490	£140	£90	£30

   Each additional night per family costs £40 no matter the season.

   (a) Find the cost of a holiday for two adults and one child, aged 13, for 19 nights during high season.

   (b) Write down the formula for the cost, £**C**, of a holiday in high season for 2 adults and one child, aged 13, lasting **n** nights, where **n** is greater than 14.

4.A car rental company on the island of Sardinia offers the following rates for
holidaymakers.

Class of car	Cost of **14** day hire	Cost of hire for each additional day
Economy	£220	£12
Family	£260	£15
Executive	£350	£18

(a) Find the cost of hiring an economy car for 17 days.

(b) Write down a formula to find the gost, £**P**, of hiring an executive car for
d days, where **d** is greater than 14.

5. The travelling expenses claimed by a salesperson depend on the engine capacity
of the car and the number of miles travelled per week.

Engine capacity	Expenses per mile
Less than or equal to 1100cc	£0.30 for **each** of the first 250 miles
Greater than 1100cc but less than 1300cc	£0.35 for **each** of the first 250 miles
Greater than or equal to 1300cc	£0.45 for **each** of the first 250 miles
Where the number of miles travelled is **greater than 250**, £0.25 can be claimed for **Each** additional mile.	

(a) Find the expenses claimed by a salesperson in a week when 600 miles is
travelled and the engine capacity is 1800cc.

(b) Write down a formula to find the expenses, £**E**, claimed when **m** miles is
travelled, where **m** is greater than 250, and the engine capacity is 1800cc.

6. Motomag is a magazine that advertises second hand cars. The cost of an advert depends
on the size of letter used in the advert and also the number of letters in the advert.
The costs are shown below.

Size of letter	Cost per letter
12	£2.50 for the first thirty letters **plus** 10p for each extra letter
14	£3.20 for the first thirty letters **plus** 12p for each extra letter
16	£3.50 for the first thirty letters **plus** 15p for each extra letter

(a) Find the cost of an advert using letter size 16 and containing a total of 42 letters.

(b) Write down a formula for the cost, £**C,** of an advert using size 16 letter and
containing **n** letters, where **n** is greater than 30.

7. Decoware is a company that produces hand-painted plates as ornaments. Workers for the company get paid depending on how many plates they paint per week and on the size of the plates. The wages are detailed below.

Diameter of plate	Wages
16 cm	£185 for the first 100 plates **plus** £3 for each extra plate
20 cm	£200 for the first 100 plates **plus** £3.50 for each extra plate
25 cm	£220 for the first 100 plates **plus** £4 for each extra plate

(a) In one week Jessica painted 120 plates of diameter 16 cm. Calculate her wage.

(b) Write down a formula for finding the wage, £**W,** of a worker who paints **p** plates of diameter 25 cm, where **p** is greater than 100.

8. The cost of taking a group of pupils to the theatre can be found from the table below.

1 adult goes free for every 10 pupils

Number of pupils	Cost per pupil	Cost per adult
Less than 10	£8.00	£12.00
10 to 19	£6.50	£11.00
20 to 29	£6.00	£10.00
30 or more	£5.00	£8.00

(a) Find the cost for a group consisting of 16 pupils and 4 adults.

(b) Write down a formula for the cost, £**C**, for a group consisting of **p** pupils and **d** adults where $20 \leq p \leq 29$.

9. The cost of a school trip to Italy depends on the number of pupils involved in the trip. These costs are shown below.

Number of pupils	Cost per pupil	Cost of each Paying adult
Less than 20	£395	£450
21 - 40	£370	£420
More than 40	£350	£400

* 1 adult goes free for every 10 pupils *

(a) Find the cost of a trip which involves 25 pupils and 5 adults.

(b) Write down a formula for the cost, £**P**, of a trip which involves **n** pupils and **m** adults where $30 \leq n \leq 39$.

10. Electoprom is a power generating company supplying electricity.
    They offer two methods of payment.

    Method 1: Annual standing charge of £60 plus 5.9 pence per unit.

    Method 2: No standing charge.
    10.5 pence for **each** of the first 1200 units **plus** 5.6 pence for any units over 1200.

    (a) Write down for, method 1, a formula for finding the cost, £C, payable if **n** units are used.

    (b) Write down, for method 2, a formula for finding the cost, £C, payable if **n** units are used, where **n** is greater than 1200.

    (c) Which method will be cheaper if a total of 12500 units are used?

11. The cost of hiring a car is shown below.

CAR HIRE

£28 per day

first 300 miles free
each additional mile 15p

    (a) Calculate the cost of hiring a car for 6 days when the mileage is 520 miles.

    (b) A car is hired for **d** days and the mileage is **m** miles where **m** is over 300 miles. Write down a formula for the cost, £C, of hiring a car.

12. While on holiday Michael's family decide to hire a car.
    There are two different schemes for hiring the same type of car.

Heinz Rental

No deposit required.
£18 per day.

First Car

£60 deposit required
plus £14 per day.

    (a) Write down a formula to find the cost, £C, of hiring a car for **d** days from Heinz Rental.

    (b) Write down a formula to find the cost, £C, of hiring a car for **d** days from First Car.

    (c) Michael's family have £285 to spend on car hire. Which scheme should they choose to have the car for as long as possible?

13. Umair and his friends are going to play football. They contact two Sports Centres about the cost of hiring a pitch. The charges per hour are

Braidpark Sports Centre: £10 for the pitch **plus** £1.75 per person.

Blairhall Sports Centre: £2.50 per person.

     (a) Write down a formula to find the cost, £C, of hiring Braidpark for one hour for x people.

     (b) Write down a formula to find the cost, £C, of hiring Blairhall for one hour for x people.

     (c) If 12 people are going to play football, which Sports Centre would be cheapest to hire for one hour.

14. Amanda hired a mobile phone at a fixed charge of £22.50 per month.
She is also charged for her total call time each month.
30 minutes of this total call time are free. The rest of her call time is charged at 40 pence per minute.

     (a) What is the total cost for Amanda's phone in a month when her total call time is 48 minutes.

     (b) Write down a formula for the total cost, £C, for Amanda's phone in a month when her total call time is t minutes, where t is greater than 30.

15. (a) One session at a Leisure Centre costs £4.
Write down an algebraic expression for the cost of x sessions.

     (b) The Leisure Centre also offers a monthly card costing £38. If you purchase this card, the first 8 sessions are free, with each additional session costing £2.50.

        (i)   Find the total cost of a monthly card and 10 sessions.
        (ii)   Write down an algebraic expression for the total cost of a monthly card and x sessions, where x is greater than 8.
        (iii)   Find the minimum number of sessions required for the monthly card to be the cheaper option.

16. Asma has a new mobile phone and considers the following daily rates.

First Call	**P – Mobile**
30 pence per minute for the first 5 minutes. 8 pence per minute AFTER the first 5 minutes.	60 pence per minute for the first 3 minutes. 6 pence per minute AFTER the first 3 minutes.

     (a) For First Call, find the cost of 20 minutes in a day.
     (b) For First Call, find a formula for the cost, £C, of m minutes in a day where $m > 5$.
     (c) For P – Mobile, find a formula for the cost, £C, of m minutes in a day where $m > 3$.
     (d) P – Mobile claims its system is cheaper.
        Find algebraically the least number of minutes which must be used each day for this claim to be true.