Modelling with series 2 - Edexcel Past Exam Questions

1. A company offers two salary schemes for a 10-year period, Year 1 to Year 10 inclusive.

Scheme 1: Salary in Year 1 is £P.
    Salary increases by £($2T$) each year, forming an arithmetic sequence.

Scheme 2: Salary in Year 1 is £($P + 1800$).
    Salary increases by £T each year, forming an arithmetic sequence.

(*a*) Show that the total earned under Salary Scheme 1 for the 10-year period is

$$£(10P + 90T).$$

(2)

For the 10-year period, the total earned is the same for both salary schemes.

(*b*) Find the value of T. **(4)**

For this value of T, the salary in Year 10 under Salary Scheme 2 is £29 850.

(*c*) Find the value of P. **(3)**

Jan 12 Q9

2. A boy saves some money over a period of 60 weeks. He saves 10p in week 1, 15p in week 2, 20p in week 3 and so on until week 60. His weekly savings form an arithmetic sequence.

(*a*) Find how much he saves in week 15. **(2)**

(*b*) Calculate the total amount he saves over the 60 week period. **(3)**

The boy's sister also saves some money each week over a period of m weeks. She saves 10p in week 1, 20p in week 2, 30p in week 3 and so on so that her weekly savings form an arithmetic sequence. She saves a total of £63 in the m weeks.

(*c*) Show that

$$m(m + 1) = 35 \times 36.$$

(4)

(*d*) Hence write down the value of m. **(1)**

June 12 Q6

3.   A company predicts a yearly profit of £120 000 in the year 2013. The company predicts that the yearly profit will rise each year by 5%. The predicted yearly profit forms a geometric sequence with common ratio 1.05.

(*a*) Show that the predicted profit in the year 2016 is £138 915.

(1)

(*b*) Find the first year in which the yearly predicted profit exceeds £200 000.

(5)

(*c*) Find the total predicted profit for the years 2013 to 2023 inclusive, giving your answer to the nearest pound.

(3)
Jan 13 Q3

4.   Lewis played a game of space invaders. He scored points for each spaceship that he captured.

Lewis scored 140 points for capturing his first spaceship.

He scored 160 points for capturing his second spaceship, 180 points for capturing his third spaceship, and so on.

The number of points scored for capturing each successive spaceship formed an arithmetic sequence.

(*a*) Find the number of points that Lewis scored for capturing his 20th spaceship.   **(2)**

(*b*) Find the total number of points Lewis scored for capturing his first 20 spaceships.   **(3)**

Sian played an adventure game. She scored points for each dragon that she captured. The number of points that Sian scored for capturing each successive dragon formed an arithmetic sequence.

Sian captured *n* dragons and the total number of points that she scored for capturing all *n* dragons was 8500.

Given that Sian scored 300 points for capturing her first dragon and then 700 points for capturing her *n*th dragon,

(*c*) find the value of *n*.   **(3)**
Jan 13 Q7

5. A company, which is making 200 mobile phones each week, plans to increase its production.

The number of mobile phones produced is to be increased by 20 each week from 200 in week 1 to 220 in week 2, to 240 in week 3 and so on, until it is producing 600 in week *N*.

(*a*) Find the value of *N*. **(2)**

The company then plans to continue to make 600 mobile phones each week.

(*b*) Find the total number of mobile phones that will be made in the first 52 weeks starting from and including week 1. **(5)**

June 13 Q7

6. Each year, Abbie pays into a savings scheme. In the first year she pays in £500. Her payments then increase by £200 each year so that she pays £700 in the second year, £900 in the third year and so on.

(*a*) Find out how much Abbie pays into the savings scheme in the tenth year. **(2)**

Abbie pays into the scheme for *n* years until she has paid a total of £67 200.

(*b*) Show that $n^2 + 4n - 24 \times 28 = 0$. **(5)**

(*b*) Hence find the number of years that Abbie pays into the savings scheme. **(2)**

June 13 (R) Q7

7. In the year 2000 a shop sold 150 computers. Each year the shop sold 10 more computers than the year before, so that the shop sold 160 computers in 2001, 170 computers in 2002, and so on forming an arithmetic sequence.

(*a*) Show that the shop sold 220 computers in 2007. **(2)**

(*b*) Calculate the total number of computers the shop sold from 2000 to 2013 inclusive. **(3)**

In the year 2000, the selling price of each computer was £900. The selling price fell by £20 each year, so that in 2001 the selling price was £880, in 2002 the selling price was £860, and so on forming an arithmetic sequence.

(*c*) In a particular year, the selling price of each computer in £s was equal to three times the number of computers the shop sold in that year. By forming and solving an equation, find the year in which this occurred. **(4)**

June 14 Q8

8. Xin has been given a 14 day training schedule by her coach.

Xin will run for A minutes on day 1, where A is a constant.

She will then increase her running time by $(d + 1)$ minutes each day, where d is a constant.

(*a*) Show that on day 14, Xin will run for

$$(A + 13d + 13) \text{ minutes.} \hspace{4cm} \textbf{(2)}$$

Yi has also been given a 14 day training schedule by her coach.

Yi will run for $(A - 13)$ minutes on day 1.

She will then increase her running time by $(2d - 1)$ minutes each day.

Given that Yi and Xin will run for the same length of time on day 14,

(*b*) find the value of *d*. **(3)**

Given that Xin runs for a total time of 784 minutes over the 14 days,

(*c*) find the value of *A*. **(3)**

June 14(R) Q10

9. Jess started work 20 years ago. In year 1 her annual salary was £17 000. Her annual salary increased by £1500 each year, so that her annual salary in year 2 was £18 500, in year 3 it was £20 000 and so on, forming an arithmetic sequence. This continued until she reached her maximum annual salary of £32000 in year *k*. Her annual salary then remained at £32 000.

(*a*) Find the value of the constant *k*. **(2)**

(*b*) Calculate the total amount that Jess has earned in the 20 years. **(5)**

June 15 Q9

10. On John's 10th birthday he received the first of an annual birthday gift of money from his uncle. This first gift was £60 and on each subsequent birthday the gift was £15 more than the year before. The amounts of these gifts form an arithmetic sequence.

   (*a*) Show that, immediately after his 12th birthday, the total of these gifts was £225. **(1)**

   (*b*) Find the amount that John received from his uncle as a birthday gift on his 18th birthday. **(2)**

   (*c*) Find the total of these birthday gifts that John had received from his uncle up to and including his 21st birthday. **(3)**

   When John had received *n* of these birthday gifts, the total money that he had received from these gifts was £3375.

   (*d*) Show that $n^2 + 7n = 25 \times 18$. **(3)**

   (*e*) Find the value of *n*, when he had received £3375 in total, and so determine John's age at this time. **(2)**

   June 16 Q9

11. A company, which is making 140 bicycles each week, plans to increase its production. The number of bicycles produced is to be increased by *d* each week, starting from 140 in week 1, to $140 + d$ in week 2, to $140 + 2d$ in week 3 and so on, until the company is producing 206 in week 12.

   (*a*) Find the value of *d*. **(2)**

   After week 12 the company plans to continue making 206 bicycles each week.

   (*b*) Find the total number of bicycles that would be made in the first 52 weeks starting from and including week 1. **(5)**

   June 17 Q4