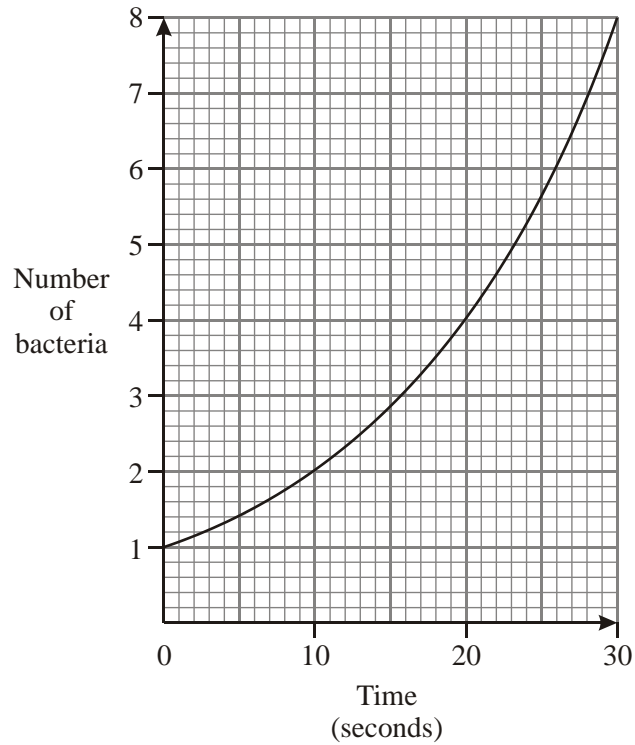


**Exponential Functions Review Packet (from November Questions)**

1. Under certain conditions the number of bacteria in a particular culture doubles every 10 seconds as shown by the graph below.



- (a) Complete the table below.

|                    |   |    |    |    |
|--------------------|---|----|----|----|
| Time (seconds)     | 0 | 10 | 20 | 30 |
| Number of bacteria | 1 |    |    |    |

- (b) Calculate the number of bacteria in the culture after 1 minute.

*Working:*

*Answer:*

(b) .....

**(Total 4 marks)**



3. (a) In city Y, house prices have increased by 3% each year for the last three years. If a house cost USD 180 000 three years ago, calculate, to the nearest dollar, its value today.
- (b) In city Z, a house worth USD 100 000 three years ago is now valued at USD 119 102. Calculate the yearly percentage increase in the value of this house.

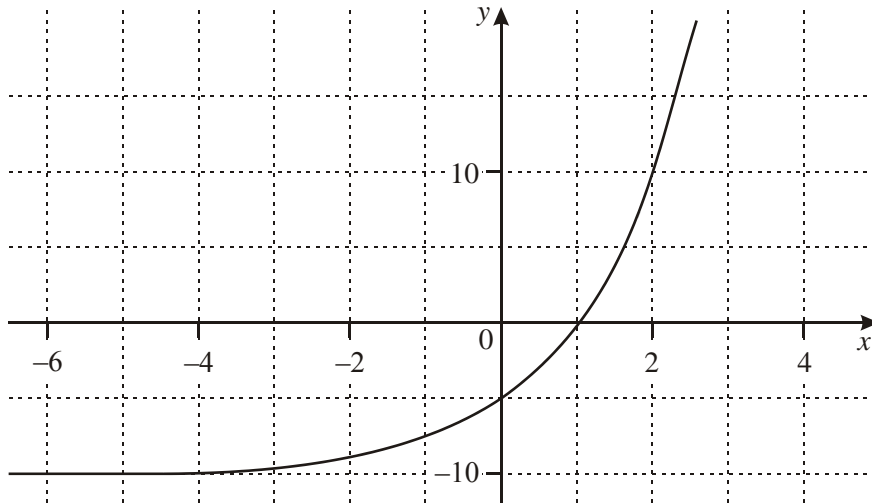
*Working:*

*Answers:*

- (a) .....
- (b) .....

**(Total 4 marks)**

4. The graph below shows the curve  $y = k(2^x) + c$ , where  $k$  and  $c$  are constants.



Find the values of  $c$  and  $k$ .

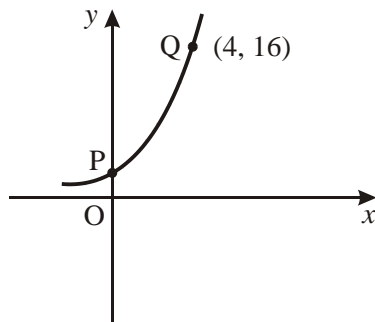
*Working:*

*Answers:*

.....  
.....

**(Total 4 marks)**

5. The diagram below shows a part of the graph of  $y = a^x$ . The graph crosses the  $y$ -axis at the point P. The point Q (4, 16) is on the graph.



**Diagram not to scale**

Find

- (a) the coordinates of the point P;
- (b) the value of  $a$ .

*Working:*

*Answers:*

- (a) .....
- (b) .....

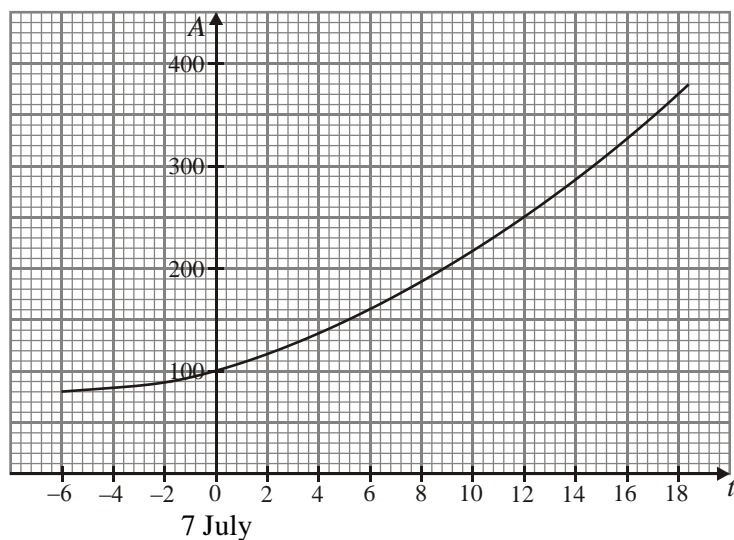
**(Total 8 marks)**

6. The area,  $A \text{ m}^2$ , of a fast growing plant is measured at noon (12:00) each day. On 7 July the area was  $100 \text{ m}^2$ . Every day the plant grew by 7.5%. The formula for  $A$  is given by

$$A = 100 (1.075)^t$$

where  $t$  is the number of days after 7 July. (on 7 July,  $t = 0$ )

The graph of  $A = 100(1.075)^t$  is shown below.



- (a) What does the graph represent when  $t$  is negative?

(2)

- (b) Use the graph to find the value of  $t$  when  $A = 178$ .

(1)

- (c) Calculate the area covered by the plant at noon on 28 July.

(3)

**(Total 6 marks)**

7. David invests 6000 Australian dollars (AUD) in a bank offering 6% interest compounded annually.
- (a) Calculate the amount of money he has after 10 years.
  - (b) David then withdraws 5000 AUD to invest in another bank offering 8% interest compounded annually. Calculate the **total** amount he will have in both banks at the end of one more year. Give your answer correct to the nearest Australian dollar.

*Working:*

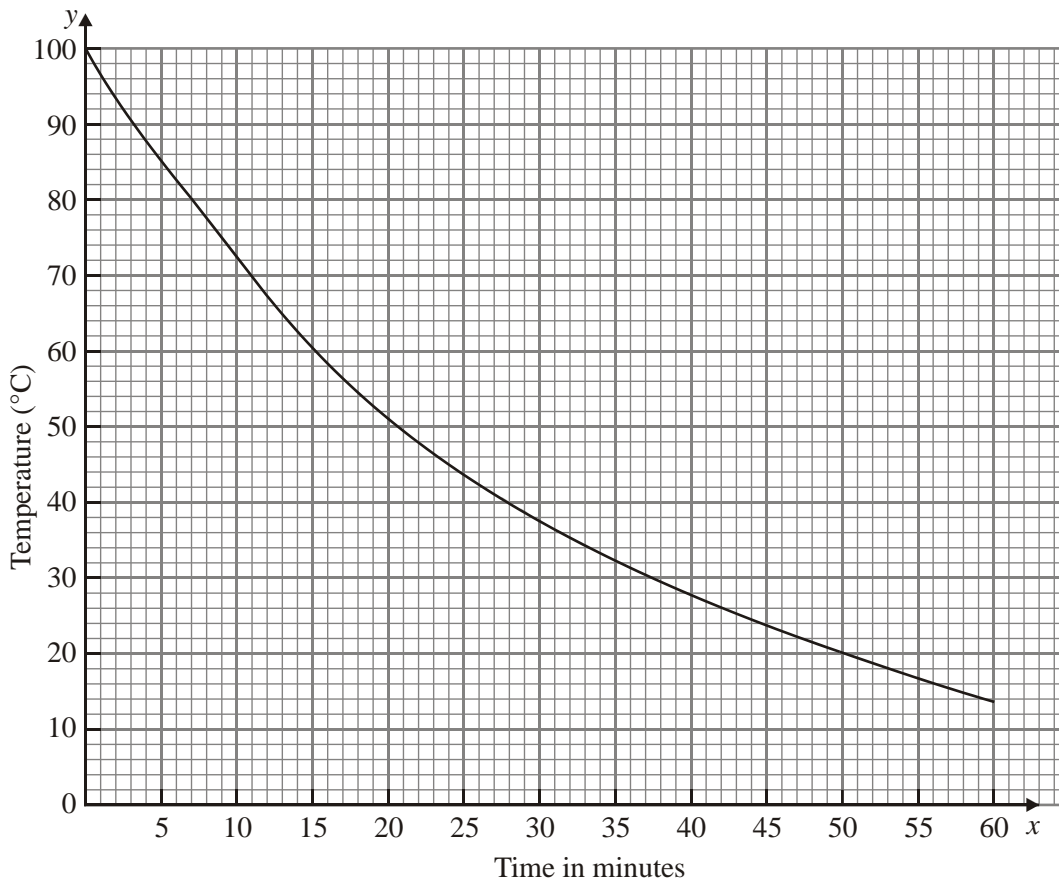
*Answers:*

(a) .....

(b) .....

**(Total 8 marks)**

8. The graph below shows the temperature of a liquid as it is cooling.



- (a) Write down the temperature after 5 minutes.
- (b) After how many minutes is the temperature 50°C?

The equation of the graph for all positive  $x$  can be written in the form  $y = 100(5^{-0.02x})$ .

- (c) Calculate the temperature after 80 minutes.
- (d) Write down the equation of the asymptote to the curve.

*Working:*

*Answers:*

(a) .....

(b) .....

(c) .....



|  |           |
|--|-----------|
|  | (d) ..... |
|--|-----------|

**(Total 8 marks)**

9. Bob invests 600 EUR in a bank that offers a rate of 2.75% compounded annually. The interest is added on at the end of each year.

- (a) Calculate how much money Bob has in the bank after 4 years.
- (b) Calculate the number of years it will take for the investment to double.

Ann invests 600 EUR in another bank that offers interest compounded annually. Her investment doubles in 20 years.

- (c) Find the rate that the bank is offering.

**(Total 6 marks)**

10. A function is represented by the equation  $f(x) = 3(2)^x + 1$ .

The table of values of  $f(x) - 3 \leq x \leq 2$  is given below.

|        |       |      |     |   |   |     |
|--------|-------|------|-----|---|---|-----|
| $x$    | -3    | -2   | -1  | 0 | 1 | 2   |
| $f(x)$ | 1.375 | 1.75 | $a$ | 4 | 7 | $b$ |

- (a) Calculate the values for  $a$  and  $b$ . (2)
- (b) On graph paper, draw the graph of  $f(x)$ , for  $-3 \leq x \leq 2$ , taking 1 cm to represent 1 unit on both axes. (4)

The domain of the function  $f(x)$  is the real numbers,  $\mathbb{R}$ .

- (c) Write down the range of  $f(x)$ . (2)
  - (d) Using your graph, or otherwise, find the approximate value for  $x$  when  $f(x) = 10$ . (2)
- (Total 10 marks)**

11. William invests \$1200 for 5 years at a rate of 3.75% compounded annually.

- (a) Calculate the amount of money he has in total at the end of the 5 years.
- (b) The interest rate then drops to 3.25%. If he continues to leave his money in the bank find how much it will be worth after a further 3 years.

**(Total 6 marks)**

12. Two students Ann and Ben play a game. Each time Ann passes GO she receives \$15. Each time Ben passes GO he receives 8% of the amount he already has. Both students start with \$100.

- (a) How much money will Ann have after she has passed GO 10 times?
- (b) How much money will Ben have after he passes GO 10 times?
- (c) How many times will the students have to pass GO for Ben to have more money than Ann?

(Total 6 marks)

13. It is thought that a joke would spread in a school according to an exponential model  $N = 4 \times (1.356)^{0.4t}$ ,  $t \geq 0$ ; where  $N$  is the number of people who have heard the joke, and  $t$  is the time in minutes after the joke is first told.

- (a) How many people heard the joke initially?
- (b) How many people had heard the joke after 16 minutes?

There are 1200 people in the school.

- (c) Estimate how long it would take for everybody in the school to hear this joke.

*Working:*

*Answers:*

- (a) .....
- (b) .....
- (c) .....

(Total 6 marks)

14. The value of a car decreases each year. This value can be calculated using the function

$$v = 32\,000r^t, t \geq 0, 0 < r < 1,$$

where  $v$  is the value of the car in USD,  $t$  is the number of years after it was first bought and  $r$  is a constant.

- (a) (i) Write down the value of the car when it was first bought.
- (ii) One year later the value of the car was 27 200 USD. Find the value of  $r$ .
- (b) Find how many years it will take for the value of the car to be less than 8000 USD.

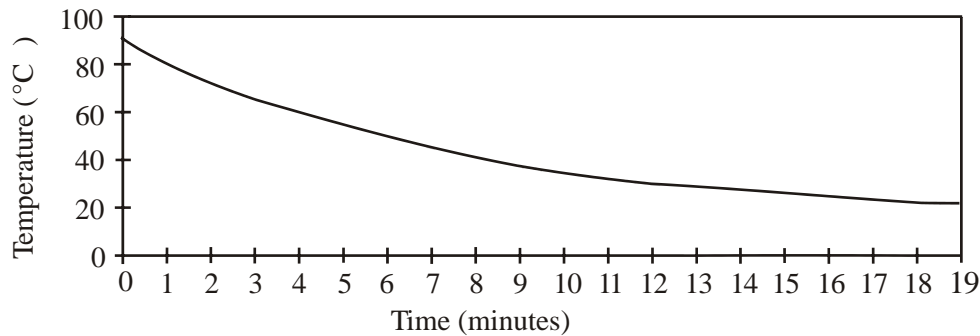
*Working:*

*Answers:*

- (a) (i).....
- (ii).....
- (b) .....

**(Total 6 marks)**

15. The following graph shows the temperature in degrees Celsius of Robert's cup of coffee,  $t$  minutes after pouring it out. The equation of the cooling graph is  $f(t) = 16 + 74 \times 2.8^{-0.2t}$  where  $f$  ( $t$ ) is the temperature and  $t$  is the time in minutes after pouring the coffee out.



- (a) Find the initial temperature of the coffee. (1)
- (b) Write down the equation of the horizontal asymptote. (1)
- (c) Find the room temperature. (1)
- (d) Find the temperature of the coffee after 10 minutes. (1)

If the coffee is not hot enough it is reheated in a microwave oven. The liquid increases in temperature according to the formula

$$T = A \times 2^{1.5t}$$

where  $T$  is the final temperature of the liquid,  $A$  is the initial temperature of coffee in the microwave and  $t$  is the time in minutes after switching the microwave on.

- (e) Find the temperature of Robert's coffee after being heated in the microwave for **30 seconds** after it has reached the temperature in part (d). (3)
- (f) Calculate the length of time it would take a similar cup of coffee, initially at 20°C, to be heated in the microwave to reach 100°C. (4)

(Total 11 marks)