1 There is no y-intercept

2 The function cuts the x-axis at $(-1, 0)$

3 $x + y - 2 = 0$

4 P is the point $(3, 7)$

5 $x - 3y + 9 = 0$

6 The gradient is constant

7 The gradient is -1

8 The slope of the function is zero

9 $y = 3$

10 $y = 3x + 3$

11 $x = 3$

12 The function makes an angle of $71.6°$ (1 d.p.) with the x-axis

13 $y = -x + 2$

14 $y = \dfrac{1}{3}x + 3$

15 The line cuts the x-axis when $x = -3$

16 The line is parallel to the y-axis

17 The gradient is positive

18 $x + 3y + 3 = 0$

19 P is the point $(2, 9)$

20 The line does not cut the x-axis

21 P is $(5, 3)$

22 When $x = 12$, $y = -10$

23 The y-intercept is $(0, 3)$

24 As x increases y decreases

Sequences and series

Match four appropriate statements from page sixteen with each of the formulae.

A

$$t_n = ar^{n-1}$$

B

$$S = P(1 + i)^n$$

C

$$t_n = a + (n - 1)d$$

D

$$S_n = \frac{n}{2}\left(2a + (n-1)d\right)$$

E

$$S_n = \frac{a(1 - r^n)}{1 - r}$$

F

$$\text{Sum} = \sum_{r=2}^{4} r(r + 3)$$

1 a = the first term

2 S_∞ never converges for this type of series

3 When $n = 10$, $a = 1$, $d = 3$
$S_n = 145$

4 $\sum$ is a symbol used to show adding terms together

5 For < 1, 5, 9, 13 ... >
$t_n = 4n - 3$

6 d = the common difference

7 When $a = 2$, $r = 3$, $n = 4$
$t_n = 54$

8 n represents the general term

9 i represents the interest rate

10 $2(5) + 3(6) + 4(7) = 56$

11 $= \sum_{r=2}^{4} r^2 + 3 \sum_{r=2}^{4} r$

12 $a = 3$, $d = 4$, $t_n = 47$, $n = 12$

13 This is the general term of a geometric sequence

14 $S_\infty = \dfrac{a}{1-r}$ if $|r| < 1$

15 r = the common ratio

16 S is the total amount of the principal and interest

17 This formula is used to calculate the amount of money in a compounding interest account

18 r is used to show how to calculate each term

19 This version of the formula is used when $r < 1$

20 This is the general term of an arithmetic sequence

21 If $r > 1$, the sequence is increasing

22 This formula is used to calculate terms of a geometric series

23 This formula is used to calculate the sum of a number of terms of an arithmetic series

24 n represents the number of interest periods

Sequences

Match four appropriate statements from page eighteen with each of the sequences.

A

$$\langle 1, 4, 9, 16, 25, ... \rangle$$

B

$$\langle 1, 2, 4, 8, 16, 32, ... \rangle$$

C

$$\langle 1, 3, 5, 7, 9, 11, ... \rangle$$

D

$$\langle 1000, 997, 994, 991, ... \rangle$$

E

$$\langle 27, 9, 3, 1, \frac{1}{3}, ... \rangle$$

F

$$\langle 0, 1, 1, 2, 3, 5, 8, 13, ... \rangle$$

1 $t_{17} = 987$

2 This is an increasing sequence

3 This is the sequence of square numbers

4 $d = -3$

5 As $n \to \infty$, $t_n \to 0$

6 $t_n = n^2$

7 $a = 1$

8 $t_n = 1003 - 3n$

9 $t_7 = 13$

10 $t_7 = 49$

11 $t_7 = \dfrac{1}{27}$

12 $t_7 = 64$

13 $t_n = 2^{(n-1)}$

14 This is a sequence of the powers of two

15 $t_n = 2n - 1$

16 $t_7 = 982$

17 $t_7 = 8$

18 $d = 2$

19 This is an arithmetic sequence

20 $r = \dfrac{1}{3}$

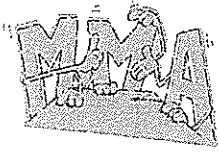**21** This is Fibonacci's sequence

22 $a = 27$

23 $t_5 - t_4 = 9$

24 $t_n = t_{n-1} + t_{n-2}$

Algebra: Terminology (1)

Find four problems from page twenty of each type listed below. Your next job is to do them.

A

Expand

B

Solve

C

Simplify

D

Factorise

E

Evaluate

F

Express as a single fraction

1 $x^2 - 7x = 0$

2 $t^2 + 5t$ when $t = 3.1$

3 $6(x - 3)$

4 $x^2 - 9$

5 $\dfrac{x + 3}{2} + \dfrac{1}{x}$

6 $3m^2$ when $m = \dfrac{1}{2}$

7 $(x + 3)(2 - x) = 0$

8 $x^2 + 15x = -50$

9 $x^7 (x^{18})^2$

10 $3x^2 - 10x - 8$

11 $\dfrac{x + 1}{2} - \dfrac{x - 3}{3}$

12 $(p + 9)(p - 6)$

13 $3a - 15 = 6$

14 $5b - 3c$ if $b = 7$, $c = -2$

15 $10a + 7b + 13a - 23b$

16 $p^2 (p - 7)$

17 $\dfrac{3p}{15}$

18 $\dfrac{x^2}{3} \cdot \dfrac{x}{7}$

19 C when $C = \dfrac{5}{9} (F - 32)$ and $F = 105$

20 $a(x - y) - 3x + 3y$

21 $3(x - 7) + 2x (x + 1)$

22 $20 - x - x^2$

23 $9x^2 \div 3x$

24 $\dfrac{5x^2y}{3} \div \dfrac{15xy^2}{24}$

Algebra: Terminology (2)

Find four problems from page twenty-two of each type listed below. Your next job is to do them.

A

Expand

B

Solve

C

Simplify

D

Factorise

E

Evaluate

F

Express as a single fraction

1. $\dfrac{3x}{2y} - \dfrac{4y}{3x}$

2. $\dfrac{a}{b} + \dfrac{b}{3a}$

3. If $a = 7$, $3a^2 =$

4. $\dfrac{t}{3} + \dfrac{t}{7}$

5. $(x^2 + 7)(2x - 3)$

6. $(3a + 4b)(a - 2b)$

7. $x^2 - 4$

8. $(a + 5)(a - 2)$ when $a = 4$

9. $\dfrac{15x^2y}{3xy}$

10. $\dfrac{3}{5}x = 9$

11. $(x + y + 3)(3x^2 - 9y)$

12. $\dfrac{1}{x + 3} - \dfrac{1}{x}$

13. $s^2 - 14s + 40$

14. $2t^2 + 5t + 3 + 7t^2 - 16t$

15. $2(5 - x) = 6(x - 1)$

16. $x^2 + 11b$ when $x = 2.3$ and $b = -7.1$

17. $\dfrac{3}{4} - \dfrac{5}{7}$

18. $ax + ay + 2cx + 2cy$

19. $(5u + 2v)(5u - 2v)$

20. $\dfrac{3}{x + 1} = \dfrac{4}{x - 2}$

21. $6(2x + 3) - 7x(5 - x)$

22. $\dfrac{x}{3} + \dfrac{x}{7}$

23. $x^2 + 7x + 12 = 0$

24. $x^2 + 7x$

Information Sharing Activities

Each of the information sharing questions has six sets of clues. The clues for each person in the group are on different pages. (E.g. clues for person A are on pages 23 and 24, clues for person B are on pages 25 and 26 etc.) All the clues for question one should be combined to solve the problem. Group members should exchange information by talking only, not be reading each other's clues.

1

Draw the function.
There is a local maximum at (1, 2).

2

As $x \to \infty$, $y \to \infty$.
There is a turning point at (–3, 54).

3

Draw the function.
The curve cuts the x-axis when $x = 2\pi$

4

There are two x-intercepts. One is at $x = 45°$

5

The curve is periodic. The y-intercept is (0, 1).

6

What is the distance between the pegs?

7

The garden is to be completely planted in azaleas.
Justify why this problem is or isn't realistic.
What is the cost of the plants for the garden?

8

Let x be the height of the box.
Draw a net of the box.

9

The field will be rectangular.
Is this problem realistic? Justify your answer.

10

The function has a minimum point at (0, 0).

Clues for person A

11

The x-axis has the equation $y = 0$.
The curve is parabolic.

12

The profit for the run of toys is $4 000.

13

Let x = the number of people at the dance.
What is critical about $x = 20$?

14

The first three people arrived at 6 am.
No one left the queue.
The shop opened at 9 am.

15

An insect has six legs.
What type of sequence is given by the numbers of insects Joe found?

16

On wet days, tigers eat 40% of people who pass by.

17

Mr Taunui is a primary school teacher. He teaches at Glentree Primary School.

18

A sailor was going on a three day journey to do some fishing.
He was 36 years old.

19

Traffic officers monitored 500 cars at a check point on the 30th of June. They only booked cars that were 10 km/h or more over the speed limit.

20

1. How many people had pulse rates above 75 beats per minute?

Information Sharing Activities

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1
The curve cuts the x-axis in three places: $-\sqrt{3}$, 0 and $\sqrt{3}$.
The domain is R.

2
What is the equation of the curve?
When $|x|$ is large and x is negative, y is negative.

3
The amplitude is 3.
The period of the curve is 4π.

4
The period is $360°$.
There is a minimum point at $x = 135°$.

5
The domain is $0 \le x \le 360°$.
Write the equation of the curve.

6
Each guy wire is 16 m long.
Is this problem realistic? Justify your answer.

7
Tony measured one side of the garden. It is 15 m long.

8
Laurence is going to fill the box with fudge for his mother. What is the maximum volume of fudge he will be able to fit in the box?

9
The farmer's name is Susan. She is building a fence around a new field.

10
The general equation of a line is $y = mx + c$.

Clues for person

B

11

The equation of the curve is $y = x^2 + 3$.
The curve is decreasing for $x < 0$.

12

The materials needed for each toy cost $10.
What is the price of each toy if 1000 toys are made?

13

Write y as a function of x.
If 500 people go to the dance, how much would the tickets cost?

14

Televisions will sell at half price!
What are the first four terms?

15

After $2\frac{1}{2}$ hours Joe had found 75 insects.
Joe's search lasted 13 hours!

16

What is the probability that Ellen arrives at Noonga?
Noonga is the capital city of Kawal.

17

The teacher needs to choose two students to send to do a job for the principal.
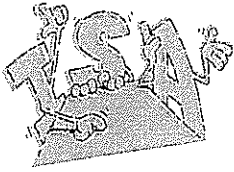
18

Joe decided to have two tins for his dinner.
The weather was sunny and hot and the sea was calm.

19

How many cars were booked for speeding on 30 June?
The legal speed limit at the check point is 80 km/h.

20

No child under the age of 5 years was tested.
The standard deviation was 8 beats.

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1

The function is increasing when x is between −1 and 1.

2

Draw the function.
There is a turning point at (3, −54)

3

There are two sections of the graph that have a positive gradient.

4

The function has no asymptotes.
It is a cosine function.

5

There are two maximum values.
An x-intercept is found at $x = 135°$.

6

A separate guy wire joins the top of the pole with each of the pegs.

7

Sarah found that one side of the garden is 18 m long.
Azaleas cost $14.95 each.

8

The box is to have square ends.
Write a formula for the volume of the box.

9

Differentiation will help maximise the area.
Susan will keep sheep in the field.

10

A is the point (2, 4).
1. What is the equation of the function?

Clues for person C

11

Draw a graph.
Differentiation will give the gradient function of the curve.

12

Each toy requires $50 of labour costs.
Graph the function.

13

Let y = the cost of a ticket.

ie. $y = \dfrac{\text{total expenses}}{\text{number of paying people}}$

14

A large department store in Sydney is having its Super Sale. Lots of people always queue for hours to be first to the best bargains.

15

Joe is looking for insects. Write a formula for the number of insects Joe found as time passed.

16

One route to Noonga goes near a camp of hungry tigers. On a fine day there is a probability of 0.7 that they will eat passers-by.

17

What is the probability that both the students chosen are girls?

18

His favourite food is pineapple chunks.
The boat is called Fandango.

19

$70 000 was collected in fines.
420 cars were travelling above the speed limit.

20

The results form a normal distribution.
Very few people had an extremely high pulse rate.

29

Information Sharing Activities

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1

There is a point of inflexion at (0, 0).
The gradient is positive only for values of x between -1 and 1.

2

There are x-intercepts at $-\sqrt{27}$, 0 and $\sqrt{27}$.
The graph has one point of inflexion.

3

It is a sine curve.
The curve goes through the origin.

4

The amplitude is $\frac{1}{2}$.

What is the equation of the curve?

5

The range is $0 \leqslant y \leqslant 2$.
There is a maximum at $x = 45°$.

6

The pegs form a regular hexagon.

7

How many azaleas should Tony and Sarah buy?
They are planting out a section of garden.

8

Laurence has 80 cm of ribbon to use.
What are the dimensions of the box Laurence is making?

9

What are the dimensions of the field?

10

Sketch the function.
The coefficient of x^2 is one.

Clues for person D

11

The upper boundary is $x = 4$.
Label all features of the graph.

12

A woodworking firm is making a new type of wooden toy.
Write a formula that links x and y.

13

Some seventh formers are organising the school dance.
On a set of axes, sketch the function y.

14

People arrive at 20 minute intervals.
Clothing will be selling at 20% of marked prices.

15

Joe found 5 insects in the first ten minutes.

16

A Safari trekker called Ellen is trekking through the African jungle.
There are two routes to Noonga, her destination.

17

The students are in standard four.
A probability tree may be useful to help solve the problem.

18

The sailor's name is Joe.
Three of the tins are baked beans.

19

The road was straight and went past a church.
The standard deviation of the cars' speeds was 10 km/h.

20

You will need to use the standard normal distribution.
Forty of the people sampled were over 65 years old.

Information Sharing Activities

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1

What is the equation of the curve?
There is a turning point at (–1, –2).

2

It is a cubic function.
The function is decreasing for $-3 < x < 3$.

3

$\dfrac{dy}{dx} = 0$ when $y = 3$.
The domain is $0 \leqslant x \leqslant 4\pi$.

4

The range is $\dfrac{-1}{2} \leqslant y \leqslant \dfrac{1}{2}, y \in R$.
Draw the function.

5

Write the equation of the curve.
The period of the function is 180°.

6

A communications pole 9 m high is standing on level ground.

7

The section of garden to be planted is triangular.
Azaleas are available in a variety of colours.

8

Laurence is making a box out of cardboard.
He has decided to put a ribbon around it in this way.

9

Maximise the area of the field.
Susan is a good mathematician.

10

2. What is the equation of the tangent to the curve at point A?

Clues for person E

11
The lower boundary is the line $x = 0$.
Shade the area between the curve, the x-axis and the boundaries.

12
Let $x =$ the number of toys made.
The manager always keeps 20 toys as gifts for friends and toy shop owners. These are not paid for.

13
The catering costs $5 per person.

14
At 6.20 am six people arrive.
How many people were in the queue when the shop opened?

15
After 40 minutes Joe had found 20 insects.
Joe started searching at 7 am.

16
One route to Noonga has patches of quicksand. The probability of sinking is 0.4.

17
Mr Taunui makes a random choice of his students.
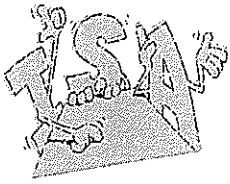There are 17 boys in the class.

18
Five of the tins are pineapple chunks.
Joe did not catch any fish on the first day.

19
The mean speed of the cars was 90 km/h.
25% of the cars had only one person inside.

20
The mean was 62 beats per minute.
2. 20% of the sample had pulse rates below what figure?

Information Sharing Activities

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1
It is a cubic function.
As $|x|$ becomes large and x is positive, y is negative.

2
The curve goes through the origin.
The range is R.

3
What is the equation of the function?
(3π, -3) is a turning point.

4
The domain is $0 \leqslant x \leqslant 360°$.
The curve cuts the x-axis at ($225°$, 0).

5
Draw the function.
There is a minimum point at ($315°$, 0).

6
The pole is in the centre of the pegs.

7
Planting instructions say to plant one azalea in every m² of garden.
The longest side of the garden is 22 m.

8
Laurence wants to maximise the volume of the box.
He has plenty of cardboard.

9
The farmer has 800 meters of fencing materials.

10
The function is parabolic.
Sketch the tangent at point A.