E Maths August Test

/70marks

1. Write down a prime number between 20 and 30.

23

[1]

2. Write 0.000 038 7 in standard form.

3.87×10^{-5}

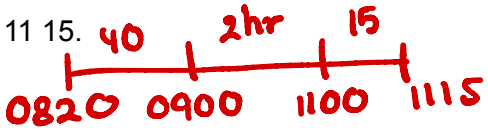
[1]

3. Write the recurring decimal $0.6\dot{3}$ as a fraction.

$x = 0.6333\ldots$
$10x = 6.3333\ldots$
$9x = 5.7$
$x = 19/30$

[2]

4. One morning, Marcia works from 08 20 to 11 15.
Find how long she works for.
Give your answer in hours and minutes.



2hr 55 mins

[2]

5. One day in Chamonix the temperature at noon was 6 °C.
At midnight the temperature was 11 °C lower. Write down the temperature at midnight.

[1]

$-5\ ^\circ C$

6. Liz takes 65 seconds to run 400 m.
Calculate her average speed.

$S = \frac{d}{t}$

$S = \frac{400}{65} = 6.15\ m/s$

[1]

7. Increase $22 by 15%.

[2]

$25.30

8. Solve.

$\frac{1-p}{3} = 4$

[2]

$1 - p = 12$

$p = -11$

9. Factorise completely.

$2a + 4b - ax - 2bx$

$2(a+2b) - x(a+2b)$

[2]

$(2-x)(a+2b)$

10. $A = (2\pi + y)x^2$

Rearrange the formula to make x the subject.

[2]

$x^2 = \frac{A}{2\pi + y}$

$x = \sqrt{\frac{A}{2\pi + y}}$

11. Simplify.

$\frac{3+x}{9-x^2}$

$\frac{3+x}{3^2-x^2} = \frac{3+x}{(3-x)(3+x)} = \frac{1}{3-x}$ [2]

12. **Without using your calculator**, work out $1\frac{3}{4} \times \frac{6}{35}$.

You must show all your working and give your answer as a fraction in its simplest form.

$\frac{7}{4} \times \frac{6}{35} = \frac{42}{140} = \frac{21}{70}$

$= 3/10$ [3]

13. The line *PQ* has equation $y = 3x - 8$ and point *P* has coordinates (6, 10).

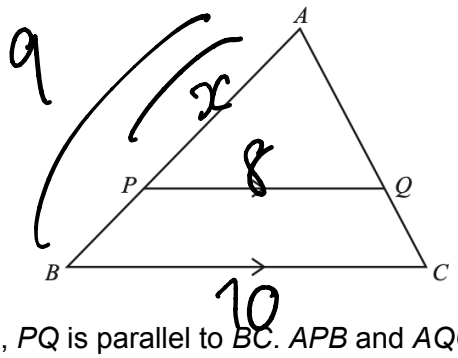
Find the equation of the line that passes through *P* and is perpendicular to *PQ*. Give your answer in the form $y = mx + c$.

gradient $= -\frac{1}{3}$

$y - 10 = -\frac{1}{3}(x - 6)$

$y = -\frac{1}{3}x + 12$ [4]

14.



NOT TO SCALE

In the diagram, *PQ* is parallel to *BC*. *APB* and *AQC* are straight lines.
PQ = 8 cm, *BC* = 10 cm and *AB* = 9 cm.

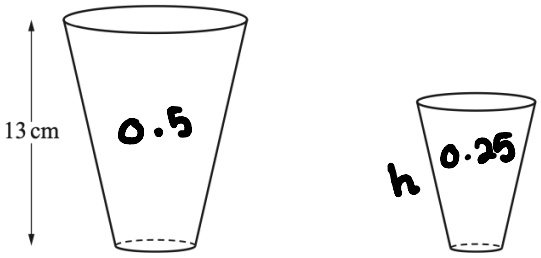
Calculate *PB*.

$\frac{8}{10} = \frac{x}{9}$

$x = 7.2$ cm

$PB = 9 - 7.2$
$= 1.8$ cm

[2]



NOT TO SCALE

The diagram shows two glasses which are mathematically similar.
The larger glass has a capacity of 0.5 litres and the smaller glass has a capacity of 0.25 litres.
The height of the larger glass is 13 cm.

Calculate the height of the smaller glass.

$\frac{h}{13} = \sqrt[3]{\frac{0.25}{0.5}}$

$h = 10.3$ cm

[3]

15. $2^p = \frac{1}{8^4}$

Find the value of p.

$2^p = (2^3)^{-4}$

$2^p = 2^{-12}$

$p = -12$

[2]

16. Solve the simultaneous equations.

You must show all your working.

$2x + 0.5y = 13$ ×2

$3x + 2y = 17$

$4x + y = 26$ ×2

$8x + 2y = 52$

$-\ 3x + 2y = 17$

$5x = 35$

$x = 7$

$28 + y = 26$

$y = -2$

[3]

17. A regular pentagon has an exterior angle, *d*.

A regular hexagon has an interior angle, *h*.

Find the fraction $\frac{d}{h}$.

Give your answer in its simplest form.

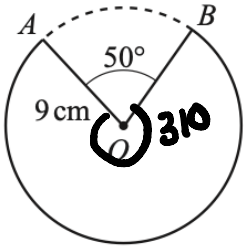
$d = \frac{360}{5} = 72$

$h = \frac{(6-2) \times 180}{6} = 120$

$\frac{d}{h} = \frac{72}{120} = \frac{3}{5}$

[4]

18.



NOT TO SCALE

The diagram shows a circle of radius 9 cm, centre *O*.

The minor sector *AOB*, with sector angle 50°, is removed from the circle.
Calculate the length of the major arc *AB*.

$\text{Arc} = \frac{310}{360} \times 2\pi r = 48.7\text{cm}$

[3]

19. (a) Anil changes $830 into euros when the exchange rate is 1 euro = $1.16 .
He spends 500 euros.
He then changes the remaining money back into dollars at the same exchange rate.

Work out how much, in dollars, Anil receives.

$830 = $\frac{1}{1.16} \times 830 = 962.8$ euro

$962.8 - 500 = 462.8$ euro

462.8 euro = 462.8×1.16

$= 536.85$ $

[3]

(b) In 2021, Anil earns $37 000.

(i) He spends $12 400 on bills in 2021.
Calculate the percentage of his earnings he spends on bills.

$\frac{12400}{37000} \times 100 = 33.5\%$

[2]

(ii) His earnings of $37 000 increase by 3.2% in 2022.

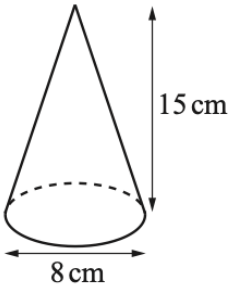
Calculate his earnings in 2022.

[2]

$37000 \times 3.2\% = 1184$

$37000 + 1184 = 38184$

20. (a)



NOT TO SCALE

A cone has base diameter 8 cm and perpendicular height 15 cm.

(i) Calculate the volume of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$]

$V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times 4^2 \times 15^5$

$= 251.3\ cm^3$

[2]

(ii) A label completely covers the curved surface area of the cone.

Calculate the area of the label as a percentage of the **total** surface area of the cone.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

$l = \sqrt{15^2 - 4^2}$

$= 14.46\ cm$

[5]

curved SA $= \pi r l$

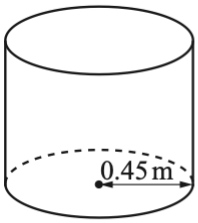
$= 181.7\ cm^2$

total SA $= 181.7 + \pi r^2$

$= 231.97\ cm^2$

$\frac{181.7}{231.97} \times 100 = 78.3\ \%$

(b)



NOT TO SCALE

An empty cylindrical container has radius 0.45 m.
300 litres of water is poured into the container at a rate of 375 ml per second.

(i) Find the time taken, in minutes and seconds, for all the water to be poured into the container.

$1\,l = 1000\,ml$

$375\,ml = 1\,sec$

$300000\,ml = ?$

$= \frac{300000}{375} = 800\,sec$

$= 13\,min\,20\,sec$

[3]

(ii) Calculate the height of the water in the container.

$300\,l = 300\,000\,cm^3$

$= 0.3\,m^3$

$cm \xrightarrow{100} m$

$cm^3 \xrightarrow{1000000} m^3$

[3]

$\pi r^2 h = 0.3$

$\pi \times 0.45^2 \times h = 0.3$

$h = 0.472\,m$

21. (a) A sequence has *n*th term $\frac{n}{2n+3}$.

(i). Find the first three terms of this sequence.

Give your answers as fractions.

$\frac{1}{5}, \frac{2}{7}, \frac{3}{9}$

$\frac{1}{5}, \frac{2}{7}, \frac{1}{3}$ [2]

(ii). The *k*th term of this sequence is $\frac{12}{25}$.

Find the value of *k*.

$\frac{k}{2k+3} = \frac{12}{25}$

$25k = 24k + 36$

$k = 36$ [2]

(b) Find the *n*th term of each sequence. $n^3 \rightarrow 1 \quad 8 \quad 27$

(i) 6, 13, 32, 69, 130, ...

7 19 37 61

12 18 24

6 6

$n^3 + 5$

$n^{th}\ term = n^3 + 5$ [2]

(ii) 100, 50, 25, 12.5, 6.25, ...

$\times \frac{1}{2}$

$ar^{n-1} = 100 \times (\frac{1}{2})^{n-1}$ [2]