1 Work out 5.92 ÷ 0.16

$\frac{592}{100} \times \frac{100}{16}$

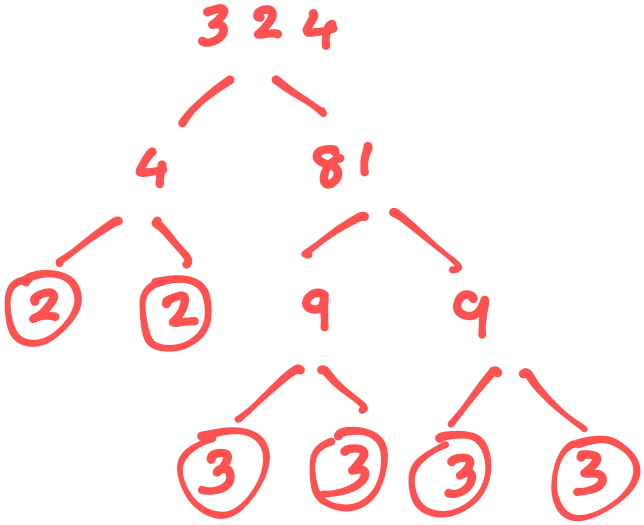
$= \frac{592}{16} = \frac{296}{8}$

$= \frac{148}{4} = 37$

37

(Total for Question 1 is 3 marks)

2 Write 324 as a product of powers of its prime factors.



2 × 2 × 3 × 3 × 3 × 3

$2^2 \times 3^4$

(Total for Question 2 is 3 marks)

3 (a) Work out $2\frac{2}{3} + 1\frac{3}{5}$

Give your answer as a mixed number.

$\frac{5 \times 8}{5 \times 3} + \frac{8}{5} \times \frac{3}{3}$

$\frac{40}{15} + \frac{24}{15} = \frac{64}{15} = 4\frac{4}{15}$

$4\frac{4}{15}$

(2)

(b) Work out $\frac{2}{3} \div \frac{3}{4}$

$\frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$

$\frac{8}{9}$

(2)

(Total for Question 3 is 4 marks)

---

4 Work out the value of $\frac{5^{-3} \times 5^{7}}{5}$

rule:

$a^m \times a^n = a^{m+n}$

$a^m \div a^n = a^{m-n}$

$\frac{5^{-3+7}}{5^1} = \frac{5^4}{5^1}$

$= 5^{4-1} = 5^3$

125

(Total for Question 4 is 2 marks)

5 Tracey writes down three numbers a, b and c.

$$a : b = 3 : 5$$
$$a : c = 4 : 7$$

(a) Find $a : b : c$

$a : b : c$

$3 : 5 : \_\_\_$ (×4 / ÷3)

$4 : \frac{20}{3} : 7$

$12 : 20 : 21$

$\frac{5}{3} \times 4 = \frac{20}{3}$

$12 : 20 : 21$

(2)

Jamie writes down three numbers d, e and f.

$$d = 2e$$
$$f = 3d$$

(b) Find $e : d : f$

let $e = x$

$d = 2x$

$f = 3(2x) = 6x$

$e : d : f$

$x : 2x : 6x$

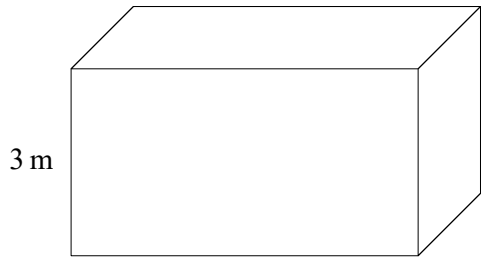
$1 : 2 : 6$

$1 : 2 : 6$

(2)

(Total for Question 5 is 4 marks)

6 The diagram shows a cuboid.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The cuboid has height 3 m
The volume of the cuboid is 21 m^3
The pressure on the floor due to the cuboid is 25 newtons/m^2

Work out the force exerted by the cuboid on the floor.

Area of base $= \frac{21}{3} = 7\ m^2$

$21 = \frac{\text{Force}}{7}$

Force $= 25 \times 7$

175 newtons

(Total for Question 6 is 3 marks)

---

7 In a bag there are counters.
The counters are all either red or blue or yellow.

The number of red counters	:	The number of blue counters	:	The number of yellow counters	=	4 : 5 : 8

The number of yellow counters is 24 more than the numbers of blue counters.

Work out the total number of counters in the bag.

R : B : Y

4 : 5 : 8

B − S = 3 parts

24 ÷ 3 = 8

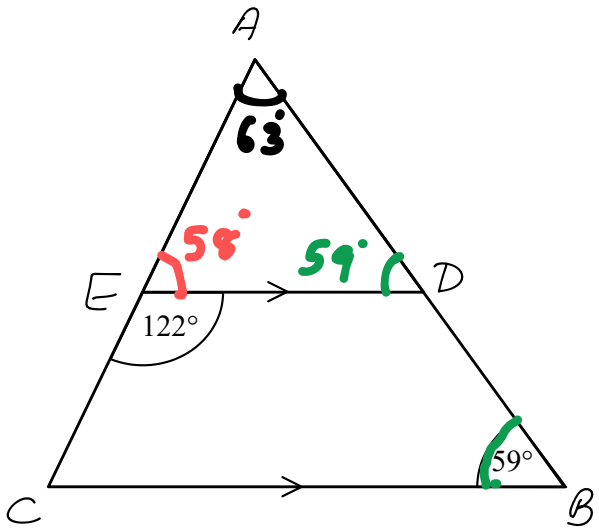
4 + 5 + 8 = 17

17 × 8 = 136

136

(Total for Question 7 is 3 marks)

8 ABC is a triangle.



AEC and APB are straight lines.
ED is parallel to CB.
Angle CED = 122°
Angle ABC = 59°

Work out the size of angle CAB
You must give a reason for each stage of your working.

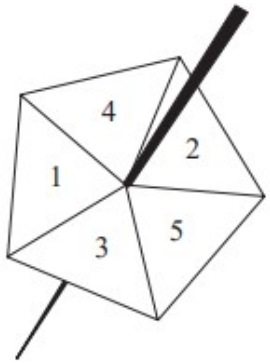
∠AED = 58° (∵ Angles on a straight line add to 180°)

∠ADE = 59° (∵ corresponding angles are equal)

∠CAB = 63° (∵ Angles in a Δ add to 180°)

(Total for Question 8 is 5 marks)

9 Roy spins a biased 5-sided spinner 48 times.



Here are his results.

Score	1	2	3	4	5
Frequency	9	10	6	7	16

Roy is now going to spin the spinner another two times.

Work out an estimate for the probability that he gets a score of 5 both times

$\frac{16}{48} = \frac{1}{3}$

$P(55) = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

$\frac{1}{9}$

(Total for Question 9 is 2 marks)

10 Solve the simultaneous equations

$2x - y = 4$ $\times 5$ — ①
$5x + 2y = 7$ $\times 2$

$$10x - 5y = 20$$
$$-\quad 10x + 4y = 14$$
$$-9y = 6$$

$$y = \frac{6}{-9} = -\frac{2}{3}$$

Sub $y = -\frac{2}{3}$ in ①

$$2x - \left(-\frac{2}{3}\right) = 4$$

$$2x + \frac{2}{3} = 4$$

$$6x + 2 = 12$$

$$6x = 10$$

$$x = \frac{10}{6} = \frac{5}{3}$$

$x =$ 5/3

$y =$ −2/3

(Total for Question 10 is 4 marks)

11 Work out the value of $8^{\frac{4}{3}} + \left(\frac{1}{3}\right)^{-3}$

$8^{\frac{4}{3}} = \left(\sqrt[3]{8}\right)^4 = (2)^4 = 16$

$\left(\frac{1}{3}\right)^{-3} = 3^3 = 27$

$16 + 27 = 43$

43

(Total for Question 11 is 3 marks)

---

12 There are p counters in a bag.
60 of the counters are white.

Jill takes at random 50 counters from the bag.
8 of these 50 counters are white.

Work out an estimate for the value of p.

$\frac{60}{p} = \frac{8}{50}$

$\frac{p}{60} = \frac{50}{8}$

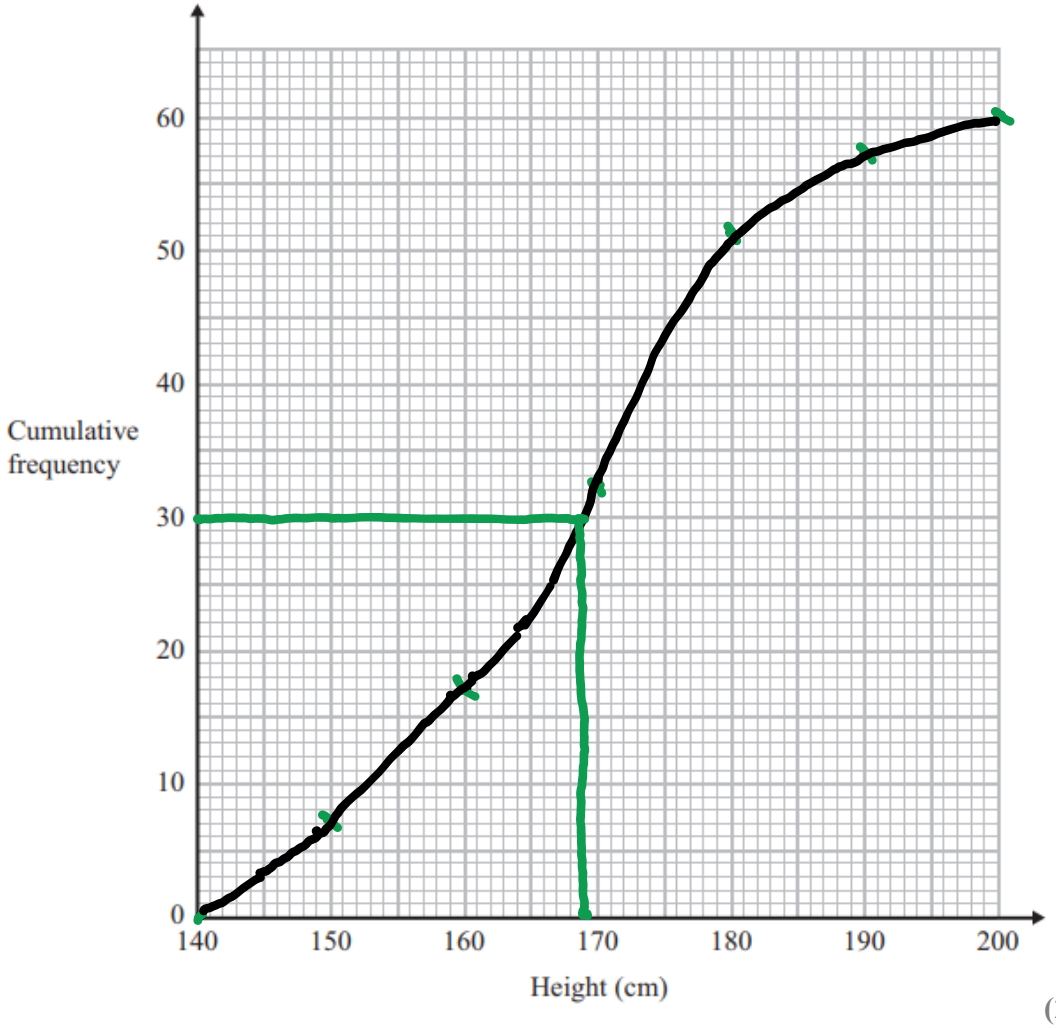
$p = \frac{50 \times 60}{8} = \frac{3000}{8} = 375$

(Total for Question 12 is 2 marks)

13 The cumulative frequency table shows the height, in cm, of some tomato plants.

Height	Cumulative Frequency
$140 < h \leqslant 150$	7
$140 < h \leqslant 160$	17
$140 < h \leqslant 170$	32
$140 < h \leqslant 180$	51
$140 < h \leqslant 190$	57
$140 < h \leqslant 200$	60

(a) On the grid, plot a cumulative frequency graph for this information.



(2)

(b) Use the graph to find an estimate for the median height of the plants.

$\frac{60}{2}$: 30th value

169 cm

(1)

(Total for Question 13 is 3 marks)

14 x is inversely proportional to y.

Complete the table of values.

x	80	16	5	4
y	2	10	32	40

$x = \frac{k}{y}$

$80 = \frac{k}{2}$

$k = 160$

$x = \frac{160}{y}$

① $x = 16 \rightarrow 16 = \frac{160}{y} \rightarrow y = \frac{160}{16} = 10$

② $y = 32 \rightarrow x = \frac{160}{32} = 5$

③ $x = 4 \rightarrow y = 40$

(Total for Question 14 is 3 marks)

---

15 The straight line **L** has equation $2y + 3x - 9 = 0$

(x, y)

Find an equation of the straight line perpendicular to **L** that passes through $(3, -7)$

$2y = -3x + 9$

$y = -\frac{3}{2}x + \frac{9}{2}$

$m_1 = -\frac{3}{2}$ ($\because l_1 \perp l_2 \Leftrightarrow m_1 = -\frac{1}{m_2}$)

$m_2 = \frac{2}{3}$

$y = \frac{2}{3}x + c$

$-7 = \frac{2}{3}(3) + c$

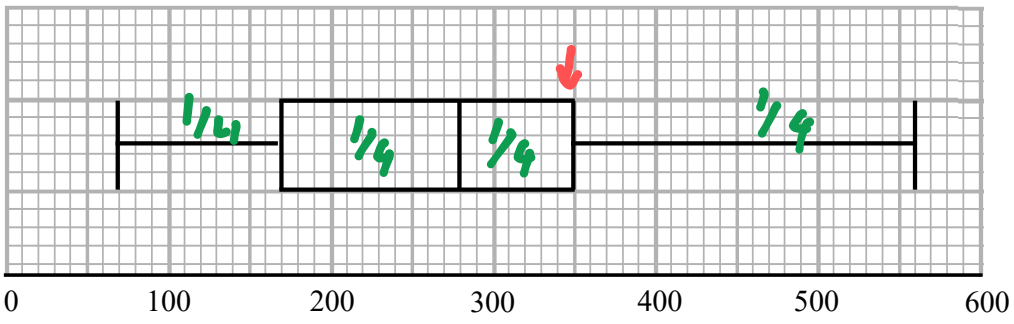
$-7 = 2 + c$

$c = -9$

$y = \frac{2}{3}x - 9$

(Total for Question 15 is 3 marks)

16 The box plot shows the number of visitors to a park on each of 180 days.



upper quartile

Work out an estimate for the number of days there were fewer than 350 visitors to the park.

$\frac{3}{4}$ of 180 $= \frac{3}{4} \times \frac{180}{1}$

$= 135$

135

(Total for Question 16 is 2 marks)

---

17 Prove that the difference between the squares of two consecutive odd numbers is a multiple of 8.

Let $2n+1$ & $2n+3$ are 2 consecutive odd no.

$(2n+3)^2 - (2n+1)^2$

$(4n^2 + 6n + 9) - (4n^2 + 4n + 1)$

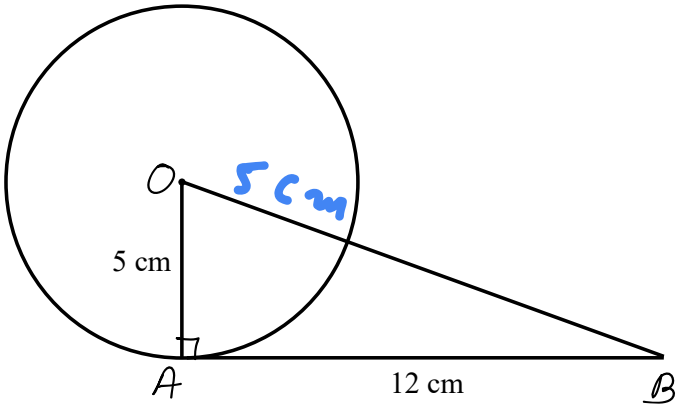
$= 4n^2 + 6n + 9 - 4n^2 - 4n - 1$

$= 8n + 8$

$= 8(n+1)$ ← always a multiple of 8

(Total for Question 17 is 4 marks)

18



A and B are points on the circumference of a circle, centre O.
AC is a tangent to the circle.
OBC is a straight line.

OA = 5 cm
AC = 12 cm

Find the length of BC.
You must show all your working.

$OA^2 + AC^2 = OC^2$

$5^2 + 12^2 = OC^2$

$169 = OC^2$

$OC = 13$ cm

OB is radius so $OB = 5$ cm

$BC = OC - OB$

$= 13 - 5$

$= 8$

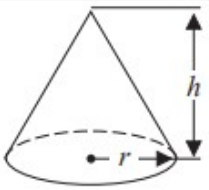
8

..... cm

(Total for Question 18 is 4 marks)

19 A cone has height 12 cm and volume 72π cm^3.

Volume of a cone $= \frac{1}{3}\pi r^2 h$



Find the diameter of the cone.
Give your answer in the form $a\sqrt{b}$ where a is an integer and b is a prime number.

$72\pi = \frac{1}{3}\pi r^2 (12)$

$72 = 4r^2$

$r^2 = \frac{72}{4} = 18$

$r = \sqrt{18} = \sqrt{9 \times 2}$

$r = 3\sqrt{2}$

Diameter $= 2r = 2 \times 3\sqrt{2}$

$= 6\sqrt{2}$

$6\sqrt{2}$ cm

(Total for Question 19 is 4 marks)

20 A , B and C are three points such that

$\overrightarrow{AB} = 6\mathbf{a} + 9\mathbf{b}$

$\overrightarrow{AC} = 10\mathbf{a} + 15\mathbf{b}$

(a) Prove that A, B and C lie on a straight line.

$\overrightarrow{AB} = 3(2\mathbf{a} + 3\mathbf{b})$

$\overrightarrow{AC} = 5(2\mathbf{a} + 3\mathbf{b})$

$\overrightarrow{AB}$ & $\overrightarrow{AC}$ are both multiple of $(2\mathbf{a} + 3\mathbf{b})$ and both pass through A.

∴ on a straight line.

so they are not parallel.

(2)

Three points D, E and F lie on a straight line such that

$\overrightarrow{DE} = 4\mathbf{a} - 5\mathbf{b}$

$\overrightarrow{EF} = -12\mathbf{a} + 15\mathbf{b}$

Find the ratio

length of DF : length of DE

$\overrightarrow{DF} = \overrightarrow{DE} + \overrightarrow{EF}$

$= (4\mathbf{a} - 5\mathbf{b}) + (-12\mathbf{a} + 15\mathbf{b})$

$\overrightarrow{DF} = -8\mathbf{a} + 10\mathbf{b}$

$= -2(4\mathbf{a} - 5\mathbf{b})$

$\overrightarrow{DF} = -2\overrightarrow{DE}$

DF is twice as long.

2 : 1

(3)

(Total for Question 20 is 5 marks)

21 The functions f and g are such that

$f(x) = 3x^2 + 1$ for $x > 0$ and $g(x) = 2x - 3$

(a) Find $f^{-1}(x)$

$y = 3x^2 + 1$

$x = 3y^2 + 1$

$x - 1 = 3y^2$

$y^2 = \frac{x-1}{3}$

$y = \sqrt{\frac{x-1}{3}}$

$f^{-1}(x) = \sqrt{\frac{x-1}{3}}$

(2)

(b) Solve $gf(x) = 95$

$2(3x^2 + 1) - 3 = 95$

$6x^2 + 2 - 3 = 95$

$6x^2 = 96$

$x^2 = 16$

$x = 4 \quad (\because x > 0)$

$x = 4$

(3)

(Total for Question 21 is 5 marks)

22 Write $\frac{\sqrt{8}}{3-\sqrt{2}}$ in the form $\frac{a\sqrt{2}+b}{c}$ where a, b and c are integers.

$\sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}$

$$\frac{2\sqrt{2}}{3-\sqrt{2}} \times \frac{(3+\sqrt{2})}{(3+\sqrt{2})}$$

$$= \frac{6\sqrt{2}+4}{9-3\sqrt{2}+3\sqrt{2}-2}$$

$$= \frac{6\sqrt{2}+4}{9-2}$$

$$= \frac{6\sqrt{2}+4}{7}$$

$\frac{6\sqrt{2}+4}{7}$

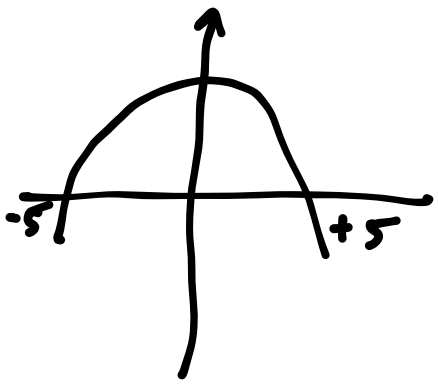
(Total for Question 22 is 4 marks)

23 Find the set of values of x for which

$$25 - x^2 > 0 \quad \textbf{and} \quad 3x^2 - 17x - 6 < 0$$

You must show all your working.

$(5 + x)(5 - x) > 0$



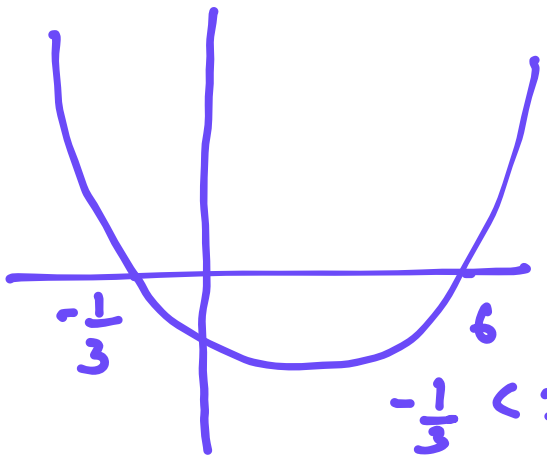
$-5 < x < 5$

$3x^2 - 17x - 6 < 0$

$3x^2 - 18x + x - 6 < 0$

$(x - 6)(3x + 1) < 0$

$x = 6 \qquad x = -\frac{1}{3}$



$-\frac{1}{3} < x < 6$

Both satisfied when

$-\frac{1}{3} < x < 5$

$-\frac{1}{3} < x < 5$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS