Paper 2 Nov. 18

1) $A \wedge B$ means A and B

3) Midpoint $(4,9)$ $(-2,1)$
is $\left(\frac{4+-2}{2}, \frac{9+1}{2}\right)$
$= (1,5)$

3) 1 3 9 27 81
is a geometric progression because each term is $\times r$ of the previous term, in this case $r=3$.
$1\ \frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}$ is also a geometric progression where $r=\frac{1}{2}$. r can take any value including negative.
So $-1\ 1\ -1\ 1\ -1$ is also a geometric progression.

4) If bearing A from B is 310 bearing B from A is
310 ± 180
In this case $310-180=130$
To return home after a walk you have to turn around $180°$ - either clockwise or anticlockwise.
If we'd chosen $310+180=490$ we would then have had to subtract 360 to produce a bearing in the range 000-360

5) $C = kd$
k is π.
Easy mark.

6)

Late	No.	Mid	Product
$0 \le t < 5$	12	$2\frac{1}{2}$	30
$5 \le t < 10$	7	$7\frac{1}{2}$	$52\frac{1}{2}$
$10 \le t < 15$	1	12½	$12\frac{1}{2}$
$t \ge 15$	0	0	0
	20	x	95

Estimate mean $= \frac{95}{20} = 4.75$
$= 4$ min. 45 sec.

To avoid any ambiguity the examiner specifically tells us there are no trains more than 15 minutes late. Even if there had been, it would still have been valid to assume a midpoint of 17½ min. in the absence of any other information.

Late	No.	Mid.	Product
$0 \le t < 2$	12	1	12
$2 \le t < 4$	0	3	0
$4 \le t < 6$	7	5	35
$6 \le t < 8$	0	7	0
$8 \le t < 10$	0	9	0
$10 \le t < 12$	1	11	11
	20	x	58

As $58 < 95$ his estimate will be LOWER.

7) $5(7x+8) + 3(2x+b) = ax + 13$
$35x + 40 + 6x + 3b = ax + 13$
$41x + 40 + 3b = ax + 13$

Equating x^1: $41x = ax$
$a = 41$

Equating x^0: $40 + 3b = 13$
$b = -9$.

8) radius is 6.
Area 2 quarter circles $= \frac{1}{2}\pi 6^2$
Area rectangle $= 12 \times 6 = 72$
Shaded $= 72 - \frac{1}{2}\pi 6^2$
$= 72 - 18\pi$
$= 15.5\ cm^2$ (3 s.f.)

9) Flow rate $= 14 \times \frac{\theta}{180}$

In this coil $= 14 \times \frac{135}{180}$

$= 10\frac{1}{2}$ min.

Time to fill $= \frac{79.8}{10.5}$

$= 7.6$

$7.6 < 7.5$ so "No" ✓

Why does the examiner give this with a question "less than 7½ min"

It's a clue as to the approximate magnitude of the answer. If you'd produced an answer of say a few seconds either you've misentered on calculator or using the wrong formula.

The examiner is trying to be helpful.

10) Perimeter is ?

$6x - 10 = 4x + 5$

$2x = 15$

$x = 7\frac{1}{2}$

So 1 side $= 35$ cm.

check $10(x-4) \Rightarrow 35$cm ✓

$35\text{cm} \times 3 = 105\text{cm}$.

$105\text{cm} > 1\text{m}$. so YES. ✓

Same philosophy as Qu 9)

The examiner is trying to be helpful. Personally I'd rather he/she just asked a straightforward question.

11) $4\left(1 - \frac{22}{57} + \frac{22}{85} - \frac{22}{105} + \frac{22}{117} - \frac{22}{242}\right)$

$= 3.0418\ldots$

$\pi = 3.1416$

diff $= -0.09955\ldots$

Hint. On calculator start with "1 − ...." and calculate

Then Ans − π to get −0.099

$0.099 < 0.1$ so demonstrated accuracy. ✓

12) $\frac{9.12}{3.2} \times \frac{10^{10}}{10^4}$

Although we could enter all this into our calculator in standard form it is safer just to calculate

$\frac{9.12}{3.2} = 2.85$ and then adjust

$\Rightarrow 2.85 \times 10^6$ ✓

This is easy. The examiner didn't even require us to make a final adjustment to get into standard form.

13) Crate is $2.5\text{m} \times 2\text{m} \times 1.2\text{m}$

Box is $0.5\text{m} \times 0.5\text{m} \times 0.5\text{m}$

To find out how many boxes fit in crate we have to examine each dimension and round down

$2.5/0.5 = 5$ ✓ OK

$2/0.5 = 4$ ✓ OK

$1.2/0.5 = 2.4 \rightarrow 2$

So no. boxes: $5 \times 4 \times 2$

$= 40$ NOT 48 ✓

Ashraf is wrong.

14) Assume prism has 3 sides
No. edges = 9
So when $n=3$ $e=9$
Two formula will produce this
$3n$ and $2n+3$
Which is the right one?
It's $3n$

15)

	Copper	:	Tin	Ratio	Actual
$\times \frac{45}{25}$	22	:	3	25	45
	39.6	:	5.4	25	45

Density = Mass/volume
Mass = density × volume
Total mass = 8.96×39.6
$+ 7.31 \times 5.4$
$= 394.29$ gram

16)
Median mass = 106 gram.

b) At 115 gram read off 42
No. apples > 115 gram
$= 50 - 42$
$= 8$
Proportion $= 8/50$
$= 4/25$

17) a is prime b is even
a^2 can be odd or even
(remember 2!)
ab can be odd or even
So $N = a^2 + ab$ could be
even or odd.

18) 20 discs

red	blue	green
10	7	3

$P(3\text{red}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$
it's Red AND Red AND Red
AND means × OR means +
$P(3\text{red}) = \frac{1}{8}$

b) All three discs different colours.
Here's a clever way to do this
for the next 2 draws
$P(\text{red then green}) = \frac{10}{19} \times \frac{3}{18}$
$P(\text{green then red}) = \frac{3}{19} \times \frac{10}{18}$
$= \frac{30 \times 2}{19 \times 18}$
so P(all three different)
$= \frac{60}{342}$
$= \frac{10}{57}$

19)
No. total choices $= 4 \times 10 = 40$
No. vegan choices $= 2 \times 3 = 6$
$\frac{6}{40} = 15\%$

20) $2n^2\left(\frac{3}{n} + n\right) + 6n(n^2 - 1)$
$= \frac{6n^2}{n} + 2n^3 + 6n^3 - 6n$
$= 6n + 2n^3 + 6n^3 - 6n$
$= 8n^3 = (2n)^3$
= The form a cube number.

Not only a cube number but
and even cube number.
If you had a graphical calculator
you could enter this whole
expression, then take the cube
root and observe the output as
2, 4, 6, 8 etc.

21) This is a standard question in every set of 3 papers. Learn it by rote.

$y \propto \frac{1}{\sqrt{x}}$

$y = k/\sqrt{x}$

$4 = k/\sqrt{9}$

$k = 4 \times 3 = 12$

note $\sqrt{}$ means only take the positive value.

$y = 12/\sqrt{x}$ ✓

b) y? when $x = 25$

$y = 12/\sqrt{25}$

$= 2.4$ ✓

Easy! ✓

22) Simplify $\frac{x^5 - 4x^3}{3x - 6}$

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

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

$= x^3(x+2)/3$ ✓

23)

PQ : QR

3 : 1

$\overrightarrow{PQ} = a$

$\overrightarrow{RQ} = -\frac{1}{3}a$ ✓

Two "traps"

1) When moving from ratios to fractions we flip through the diagram which wasn't necessary gave the clue.
2) Vector points the other way so it's negative.

24) Curve sketching exercise.

$f(x) \rightarrow f(x+2)$

so curve shifts 2 units TO THE LEFT

Remember it's back to front from what you might expect.

Make sure you connect points smoothly

25) Let $AC = h$

$\tan 49^\circ = \frac{h}{16}$

so $h = 16 \tan 49$

$\frac{h}{\sin x} = \frac{20}{\sin 35}$

so $\sin x = \frac{h \sin 35^\circ}{20}$

$x = \sin^{-1}\left(\frac{16 \tan 49 \times \sin 35}{20}\right)$

$= 31.9^\circ$ ✓

Enter all this into your calculator efficiently. Do the $\sin^{-1}$ at the end.

26) $f(x) = \frac{x}{x+2}$ $g(x) = x^2 - 2$

$fg(x) = \frac{x^2 - 2}{x^2}$

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

$= 1 - 2x^{-2}$ ✓

27) $(3, \frac{1}{64})$ lies on curve $y = k^x$

so $\frac{1}{64} = k^3$ so $k = \frac{1}{4}$ ✓

now $(\frac{1}{2}, \frac{1}{2})$ to lie on curve?

$y = (\frac{1}{4})^{1/2}$

$= \frac{1}{2}$

so $(\frac{1}{2}, \frac{1}{2})$ does lie on curve ✓

28) The acceleration during the last 8 seconds is the gradient of that portion of the graph.

Gradient $= \frac{\Delta v}{\Delta t}$

change in v / change in t

$= \frac{2}{8}$

$= 0.25$ m/sec/sec. ✓

b) Now area under curve represents distance so

Let final speed $= v$

$\frac{1}{2}(v-2) \times 6 + \frac{1}{2}(v-2+v) \times 8 = 80$

(area trapezium)

$(\frac{1}{2}v - 1)6 + (v-1)8 = 80$

$3v - 6 + 8v - 8 = 80$

$11v = 94$

$v = \frac{94}{11}$

$= 8.545$ m/s. ✓

ROBERT GOODHAND