1. The fraction, p, of an adult's dose of medicine which should be given to a child who weighs w kg is given by the formula

$$p = \frac{3w + 20}{200}$$

A child weighs 35 kg.

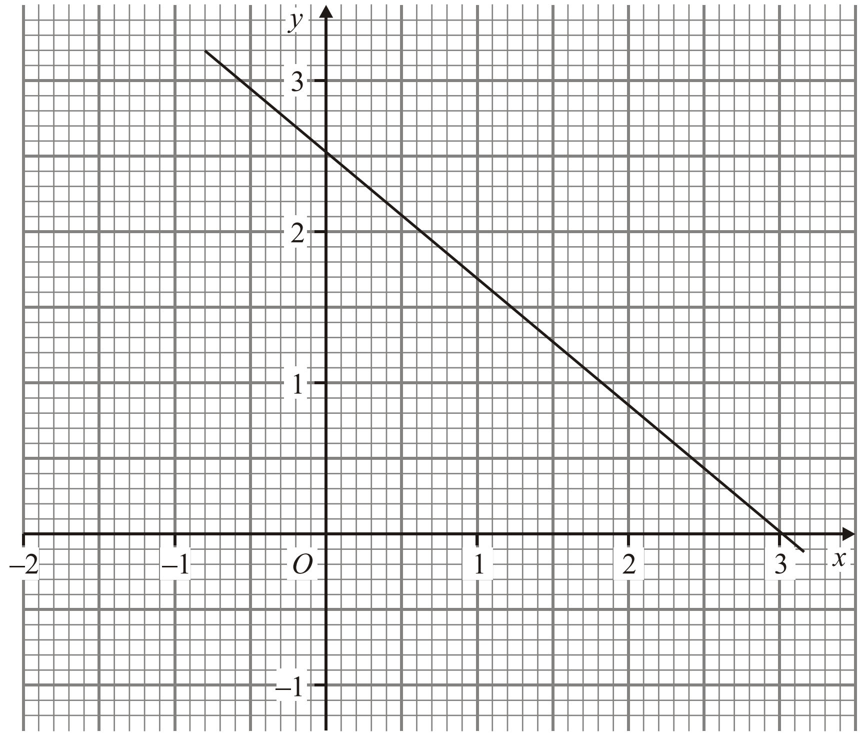
(a) Work out the fraction of an adult's dose which should be given to this child.
Give you answer as a fraction in its simplest form.

....
(2)

(b) Use the formula $p = \dfrac{3w + 20}{200}$ to find the weight of a child whose dose is the same as an adult's dose.

.... kg
(3)
(Total 5 marks)

2.



The line with equation $6y + 5x = 15$ is drawn on the grid above.

(a) Rearrange the equation $6y + 5x = 15$ to make y the subject.

y = ...

(2)

(b) The point $(–21, k)$ lies on the line.
Find the value of k.

k = ...

(2)

(c) (i) On the grid, shade the region of points whose coordinates satisfy the four inequalities

$$y > 0, \qquad x > 0, \qquad 2x < 3, \qquad 6y + 5x < 15$$

Label this region ***R.***

P is a point in the region ***R***. The coordinates of P are both integers.

(ii) Write down the coordinates of P.

(.......... , ...)

(3)

(Total 7 marks)

3.

$$y = \sqrt{\frac{r + t\sin x^\circ}{r - t\sin x^\circ}}$$

$r = 8.8$
$t = 7.2$
$x = 40$

Calculate the value of y. Give your answer correct to 3 significant figures.

$y =$ ....

(Total 3 marks)

4.

$$y = \sqrt{\frac{r + t\sin x°}{r - t\sin x°}}$$

$r = 8.8$
$t = 7.2$
$x = 40$

(a) Calculate the value of y. Give your answer correct to 3 significant figures.

$y =$ ....
(3)

$y = 2$
$t = 10$
$x = 30$

(b) Find the value of r.

$r =$ ....
(3)
(Total 6 marks)

5. $$P = \pi r + 2r + 2a$$

$P = 84$

$r = 6.7$

(a) Work out the value of a.
Give your answer correct to 3 significant figures.

$a =$ ………………..

(3)

(b) Make r the subject of the formula

$$P = \pi r + 2r + 2a$$

$r =$ ……………………

(3)

(Total 6 marks)

6. The distance, D, travelled by a particle is directly proportional to the square of the time, t, taken.

When $t = 40$, $D = 30$

(a) Find a formula for D in terms of t.

D = ...

(3)

(b) Calculate the value of D when $t = 64$

....

(1)

(c) Calculate the value of t when $D = 12$
Give your answer correct to 3 significant figures.

....
(2)
(Total 6 marks)

7. When you are h feet above sea level, you can see d miles to the horizon, where

$$d = \sqrt{\frac{3h}{2}}$$

(a) Calculate the value of d when $h = 8.4 \times 10^3$
Give your answer in standard form correct to 3 significant figures.

d = ...
(2)

(b) Make h the subject of the formula $d = \sqrt{\frac{3h}{2}}$

h =...............................

(2)

(Total 4 marks)

8. (a) Expand and simplify $(x + 3)(x - 4)$

....

(2)

(b) Expand and simplify $(2x + 5)(3x - 4)$

....

(2)

(c) Factorise $x^2 + 7x + 10$

....

(2)

(d) Simplify fully $3p^5q \times 4p^3q^2$

....

(2)

(e) $p = 3t + 4(q - t)$

Find the value of q when $p = 6$ and $t = 5$

$q =$ ....

(3)

(Total 11 marks)

9. $A = \dfrac{h(x+10)}{2}$

$A = 27$

$h = 4$

Work out the value of x

$x =$ ....

(Total 3 marks)

10. A straight line has equation $y = \frac{1}{2}x + 1$

The point P lies on the straight line.
P has a y-coordinate of 5.

(a) Find the x-coordinate of P.

....

(2)

(b) Rearrange $y = \frac{1}{2}x + 1$ to make x the subject.

....

(2)
(Total 4 marks)

11. $P = \pi r + 2r + 2a$

$P = 84$
$r = 6.7$

Work out the value of a.
Give your answer correct to 3 significant figures.

a = ……………………………
(Total 3 marks)

1. (a) $\frac{5}{8}$ 2

$\frac{125}{200}$

M1 for $\frac{125}{200}$
A1 cao

(b) 60 3

$\frac{3w+20}{200} = 1$
$3w + 20 = 200$

M1 $\rho = 1$ *stated or used*
M1 dep $3w + 20 = 200$ *oe*
A1 cao

[5]

2. (a) $y = \dfrac{15 - 5x}{6}$ 2

$6y = 15 - 5x$

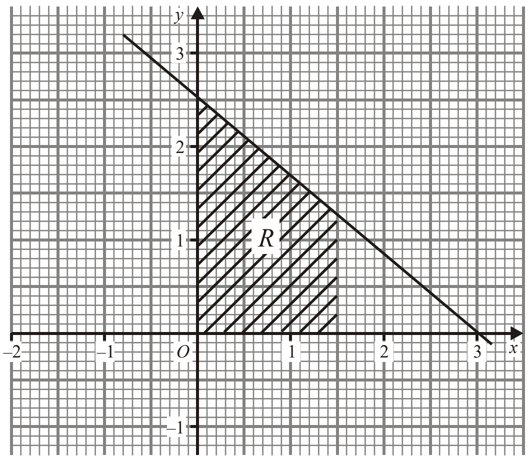
M1 for either $6y = 15 - 5x$ or for $\dfrac{5x}{6} + y = \dfrac{15}{6}$
or $-6y = 5x - 15$ or a correct ft on sign error to $y =$
A1 for $y = \dfrac{15 - 5x}{6}$ oe

(b) 20 2

$6k + 5(-21) = 15$

M1 for subst. of $x = -21$ (or $x = 21$) into given eq^n or answer to (a)
A1 for $k = 20$

(c) (i) Region R indicated 3



B2 correct region shaded (accept unshaded if R clear)
(B1 shaded (R) region satisfies 3 of the 4 given inequalities with same boundaries)

(ii) (1,1)
B1 for (1,1)

[7]

3. 1.79 3

$$\sqrt{\frac{8.8+7.2\sin 40}{8.8-7.2\sin 40}}$$
$$=\sqrt{\frac{13.428}{4.172}}=\sqrt{3.218}$$

M1 for correct substitution of all values into numerator or denominator (separately) condoning sin x 40,
or for $\frac{40.72}{10.28}$ *(= 3.96) or for* $\frac{48.8}{8.8}$ *(= 5.54)*
A1 for 13.4(28) or 4.1(72) or 3.2(18)
A1 1.79 - 1.8

[3]

4. (a) 1.79 3

$$\sqrt{\frac{8.8+7.2\sin 40}{8.8-7.2\sin 40}}$$

$$=\sqrt{\frac{13.428}{4.172}}=\sqrt{3.218}$$

M1 for correct substitution of all values into numerator or denominator (separately) condoning sin x 40,
or for $\frac{40.72}{10.28}$ *(= 3.96) or for* $\frac{48.8}{8.8}$ *(= 5.54)*
A1 for 13.4(28) or 4.1(72) or 3.2(18)
A1 1.79 – 1.8

(b) $8\frac{1}{3}$ 3

$$2=\sqrt{\frac{r+10\sin 30}{r-10\sin 30}}$$

$$2=\sqrt{\frac{r+5}{r-5}}$$

$$4=\frac{r+5}{r-5}$$

$$r=8\frac{1}{3}$$

M1 for $2=\sqrt{\frac{r+10\sin 30}{r-10\sin 30}}$
M1 square both sides
A1 $8.3-8\frac{1}{3}$

[6]

5. (a) 24.8 3

84 = 6.7π + 2 × 6.7 + 2a
2a + 13.4 = 62.95….
or 2a + 34.44 = 84

M1 for substituting correctly, π may be left
M1 for correct rearrangement as far as ± 2a
A1 for 24.7-24.8

(b) $\dfrac{P-2a}{\pi+2}$ 3

$P = \pi r + 2r + 2a$
$P - 2a = \pi r + 2r$
$P - 2a = (\pi + 2)r$

M1 subtracting 2a from each side
M1 for factorising to get $(\pi + 2)r$
A1 for $\dfrac{P-2a}{\pi+2}$ oe
S.C $\dfrac{p-2a}{5.14}$ oe is M1 M1 A0

[6]

6. (a) $D = kt^2$
$30 = k(40)^2$
$k = 30/1600$ (= 0.01875)
$D = \dfrac{30}{1600}t^2$ 3

M1 for $D = kt^2$ seen or implied ($k \neq 1$)
M1(dep) for substitution or sight of $k = 30/40^2$ oe
A1 for D $\dfrac{30}{1600}t^2$ oe
k = 0.018(75) truncated or rounded

(b) $\dfrac{30}{1600} \times 64^2$
76.8 1

M1 for 'k' × 64^2 ($k \neq 1$) seen

(c) (t^2 =) 12 ÷ (30/1600)
t = $\sqrt{640}$ = 25.298...
25.3 2

M1 for 12 ÷ 'k'($k \neq 1$)
A1 for 24.4 to 25.9 (ignore –25.3)

[6]

7.	(a)	12 600 or 1.26×10^4 1.12×10^2 *M1 for 12 600 or 1.26×10^4* *A1 for $1.12 \times 10^2 - 1.123 \times 10^2$ oe*	2
	(b)	$d^2 = \frac{3h}{2}$ $= \frac{2d^2}{3}$ *M1 for squaring each side* *A1 for $\frac{2d^2}{3}$ oe*	2

[4]

8.	(a)	$x^2 - 4x + 3x - 12$ $= x^2 - x - 12$ $x^2 - x - 12$ *M1 for exactly 4 terms correct ignoring signs (x^2, 4x, 3x, 12)* *or 3 out of 4 terms with correct signs (x^2, –4x, +3x, –12)* *A1 cao*	2
	(b)	$6x^2 - 8x + 15x - 20 = 6x^2 + 7x - 20$ $6x^2 + 7x - 20$ *M1 for exactly 4 terms correct ignoring signs ($6x^2$, 8x, 15x, 20)* *or 3 out of 4 terms with correct signs ($6x^2$, –8x, +15x, –20)* *A1 cao*	2
	(c)	$(x + 2)(x + 5)$ *B2 cao* *(B1 for exactly one of (x + 2), (x+ 5))*	2
	(d)	$12p^8q^3$ *B2 cao* *(B1 for any 2 out of 3 terms correct in a product* *or 3 terms correct in a sum or part product)*	2

(e) $6 = 15 + 4(q-5)$

$6 = 15 + 4q - 20$

$11 = 4q$

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

M1 for correct substitution of p and t.
M1 for correct expansion of 4(q – t) oe (eg 4q – 20, 4q – 4t)
A1 11/4 or 2 ¾ or 2.75
or
M1 for correct substitution of p and t.
M1 for $\frac{p-3t}{4} = q - t$ *oe*
A1 11/4 or 2 ¾ or 2.75

[11]

9. $27 = \frac{4(x+10)}{2}$

$27 = 2x + 20 = 3.5$ 3

M1 $27 = \frac{4(x+10)}{2}$

M1 Expansion to 4x + 40 or × 2 to give 54 = 4(x + 10)

A1 for 3.5, accept $\frac{14}{4}$ *or* $\frac{7}{2}$

Sc: B1 for x = 11

[3]

10. (a) 8 2

$5 = 0.5x + 1$

M1 for 5 = 0.5 x + 1
A1 cao

(b) $x = 2y - 2$ oe 2

M1 for correctly multiplying both sides by 2 or correctly isolating $\frac{x}{2}$

A1 for x=2y – 2 oe or $x = \frac{y-1}{0.5}$ *oe*

SC: B1 for x = 2y – 1

[4]

11. 24.8 3

$84 = 6.7\pi + 2 \times 6.7 + 2a$
$2a + 13.4 = 62.95….$
or $2a + 34.44 = 84$

M1 for substituting correctly, π may be left
M1 for correct rearrangement as far as ± 2a
A1 for 24.7 – 24.8

[3]

1. In part (a) the fraction $\frac{125}{200}$ was seen often but many candidates could not simplify this correctly to $\frac{5}{8}$. Some candidates used 35 instead of 3 × 35 and obtained $\frac{55}{200}$. Part (b) was not answered well and many candidates attempted to use the 35g from part (a). Only a small number of candidates realised, and stated, that $p = 1$ and even when they did there was little evidence of algebraic manipulation to solve the problem. Correct answers were often found by trial and error.

2. **Mathematics A**

Paper 3

The success rate for this question as a whole was very low and many weaker candidates did not attempt it. Most marks were gained in part (a) with the method mark being awarded to those candidates who showed a correct first step to get $6y = 15 – 5x$. In part (b) most candidates seemed to have no idea that –21 was an x value and did not connect this part of the question to part (a). Correct answers were rare. Very few candidates gained both marks in part (c) for shading the correct region. Some gained one mark for a region satisfying three of the four given inequalities but the line $x = 1.5$ was rarely drawn correctly for the fourth inequality. Candidates sometimes gave the correct coordinates in (ii) even though no other marks had been gained the term “integer” was not well understood by many weaker candidates.

Paper 5

In part (a) many candidates rearranged the equation correctly to find y. In part (b) those who substituted $x = – 21$ gained the method mark but sign errors were common in the simplification process. Another approach was to multiply 2.5 by 7 but the vast majority who attempted this method forgot to add the 2.5 and gave the wrong value for k as 17.5. Those candidates who attempted part (c) frequently gave the correct coordinates of P but correct answers to (i) were uncommon. Many candidates failed to recognise the boundary x=1.5.

Mathematics B Paper 16

Many candidates at this level found the demands of this question too great. Algebraic manipulation often presents problems although there were some very good attempts to transform the formula in part (a). The usual mistakes of $y = (5x - 15)/6$ and $15/6 - 5x$ were often seen. Many candidates having got $6y = 15 - 5x$ then tried to subtract $5x$ from 15 to give $10x$.
In part (b) very few were able to equate -21 to x, and thus any substitution was rarely started. When it was, errors with the signs were commonplace.
Only a very small minority were able to draw a correct fourth boundary in part (c), and more often than not when a mark was gained it was for shading the given triangle.
The point (1, 1) was given by the more able candidate only. ($1x$, $1y$) was seen on enough occasions to be worthy of mention.

3. This is probably the question in which candidates lost most marks through not showing intermediate steps of working out. It is perhaps all too easy simply to attempt to plug the figures into a calculator, yet more than half the candidates gave just an incorrect answer on the answer line and lost all 3 marks. Clear evidence of correct substation would have earned the first mark. Nearly all errors could be linked to incorrect processing of operations on the calculator.

4. Part (a) was a question which tested substitution into a formula. Virtually all candidates were able to carry out the substitution but many went on to make errors on the evaluation of either the numerator or the denominator. The most common error was to evaluate the denominator as (8.8 – 7.2) sin 40°. Candidates who put in the step of evaluating sin 40° and then remembering BIDMAS did seem to be more successful.
Candidates found part (b) challenging. Most could substitute correctly into the formula, evaluate 10sin 30° and then square both sides to get $\frac{r+5}{r-5} = 4$. There were few candidates who could go on from there and then solve the equation. An alternative strategy sometimes seen was to manipulate the given expression without any substitution into the form $r =$. This was rarely successful.

5. This proved to be straightforward with the vast majority getting full marks. A few candidates gained a mark by substituting in correctly but then divided the Left Hand Side rather than subtracting from it.
Part (b) was poorly answered. Most candidates realised that they had to subtract $2a$ from both sides, but then were unable to deal with the two terms in r.Very few candidates realised that they had to factorise to get $(\pi + 2)r$ on the right hand side. Strangely a minority of candidates divided by π then by +2 leaving $r + r$ on the right hand side.

6. Many candidates ignored ‘square’ in the question and produced answers involving only direct proportion. In part (a), only the best candidates started their answer with a suitable equation involving a constant. Some found the constant correctly but did not combine this with the D and t^2 to produce a final equation. Many candidates unable to gain full credit in (a) often gained some credit in (b) and (c) for a correct method.

7. **Paper 5524**

Many made an attempt at this question. In part (a) it was common to see correct substitution into the formula, but even with calculators candidates were unable to process the calculation and then find the square root, the most common error being $\sqrt{3} \times 50 \div 2 = 43.3$. Part (b) was only for the better candidates, as most fell at the first hurdle and failed to square both sides; subsequent attempts at rearranging algebra were usually incorrect.

Paper 5526

Most candidates substituted in the correct values for part (a), but a minority omitted the leading number of 3. Correct substitution usually produced the correct value of 112, although there was a common error to take the square root of 3h, omitting the 2 in the denominator.

Part (b) proved more challenging, with many candidates adopting bizarre processes to deal with the square root sign. A small minority who started correctly by squaring both sides were unable to handle the 3 and 2 in the expression correctly.

8. Parts (a) to (d) were straightforward tests of algebraic manipulation. Generally, these were carried out well, with few errors. There were some difficulties with part (d) with answers such as pq$(3p^4 \times 5p^2q)$, $7p^8q^3$ and $12p^8 + q^3$.

Part (e) proved more of a challenge for weaker candidates. There are essentially two approaches; the first approach involves rearranging the algebra to $q = \dfrac{p - 3t + 4t}{4}$ and then substituting for p and t. This gives the value of q directly. The second approach is to substitute for p and t first and then to solve the resulting equation. The second approach proved to be more popular and was generally successful. However, many candidates made a BIDMAS error of $6 = 15 + 4(q - 5) \Rightarrow 6 = 19(q - 5)$.

9. Higher Tier

Most candidates started by substituting the values into the formula and then went on to solve the resulting equation. The most popular approach was to write $27 = \frac{4(x+10)}{2}$ followed by expanding the brackets and then multiplying each side by 2. Some candidates reached for the calculator and resorted to trial and improvement. If they got the 3.5 then they were awarded all 3 marks, otherwise they would only get the mark for the substitution. The most common error was in getting the expansion incorrect, with $4x + 10$ seen.

A few candidates tried to manipulate the formula first to make x the subject. This was generally successful for stronger candidates.

Intermediate Tier

A significant number of candidates used a trial and improvement method here and many were successful. Those who used algebra often scored a mark for correct substitution in to the given formula. But for many the error was in failing to expand the bracket correctly; $4x + 20$ was seen in many cases instead of $4x + 40$.

10. In part (a) a common incorrect answer was 9 arising from candidate's being unable to deal with rearranging the given equation once a value had been substituted in correctly. Similar difficulties were encountered in part (b). Those candidates who decided to start by multiplying by 2 regularly failed to multiply the 1 by 2 as well. This led to a popular incorrect answer of $x = 2y - 1$

11. Over 80% of candidates were able to score full marks on this question. Common errors generally involved incorrect algebraic processes when attempting to rearrange the equation after substitution had taken place. There was also some incorrect use of calculators.