1. 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) Write down the equation of a different straight line that is parallel to $y = \frac{1}{2}x + 1$.

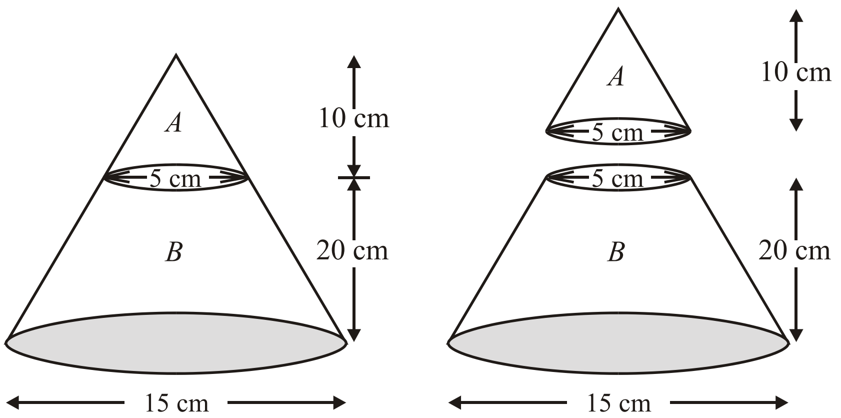
....
(1)

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

....
(2)
(Total 5 marks)

2.

Diagram **NOT** accurately drawn



The diagram represents a large cone of height 30 cm and base diameter 15 cm.

The large cone is made by placing a small cone *A* of height 10 cm and base diameter 5 cm on top of a frustum *B*.

(a) Calculate the volume of the frustum *B*.
Give your answer correct to 3 significant figures.

.........................cm^3

(3)

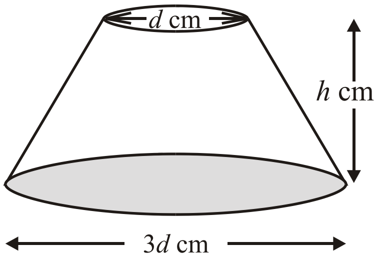


Diagram **NOT** accurately drawn

The diagram shows a frustum.
The diameter of the base is $3d$ cm and the diameter of the top is d cm.
The height of the frustum is h cm.

The formula for the curved surface area, S cm^2, of the frustum is

$$S = 2\pi d\sqrt{h^2 + d^2}$$

(b) Rearrange the formula to make h the subject.

h = ...

(3)

Two mathematically similar frustums have heights of 20 cm and 30 cm.

The surface area of the smaller frustum is 450 cm^2.

(c) Calculate the surface area of the larger frustum.

.........................cm^2

(2)

(Total 8 marks)

3. (a) Show that $(2a - 1)^2 - (2b - 1)^2 = 4(a - b)(a + b - 1)$

(3)

(b) Prove that the difference between the squares of any two odd numbers is a multiple of 8. (You may assume that any odd number can be written in the form $2r - 1$, where r is an integer).

(3)
(Total 6 marks)

4. 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 $p = \frac{3w+20}{200}$ to find the weight of a child whose dose is the same as an adult's dose.

……………………… kg

(3)

(Total 5 marks)

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

……………………… kg

(3)

(b) Make w the subject of the formula $p = \dfrac{3w+20}{200}$

$w =$ ....

(3)

$$\frac{3w+20}{200} = \frac{A}{A+12}$$

(c) Express A in terms of w.

$A =$ ....

(4)

(Total 10 marks)

6. Two numbers have a difference of 15 and a product of 199.75

The larger of the two numbers is x.

(a) Show that

$$x^2 - 15x - 199.75 = 0$$

(3)

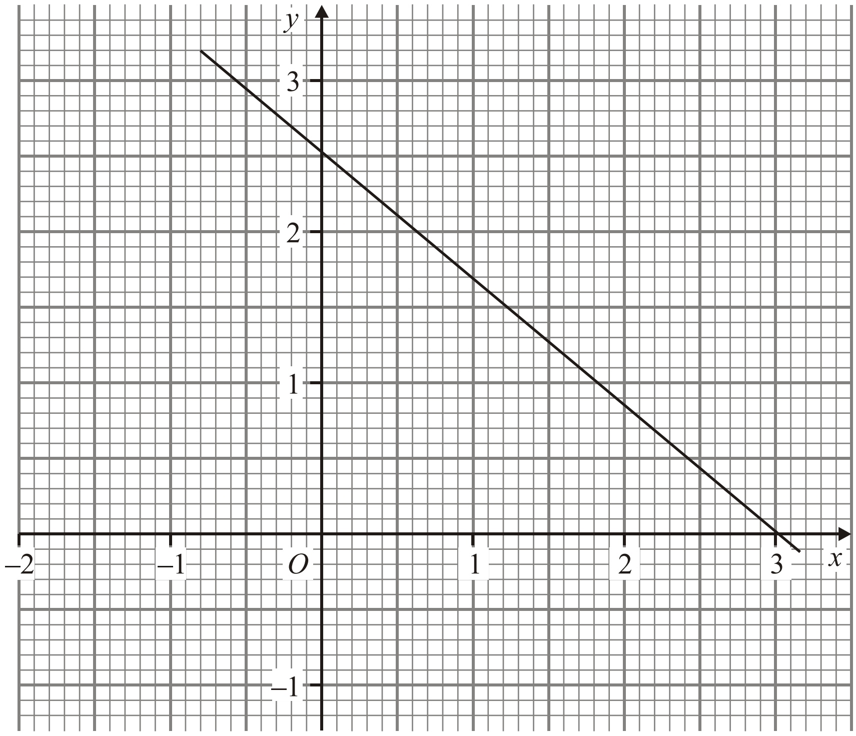
(b) Solve the equation

$$x^2 - 15x - 199.75 = 0$$

....

(3)
(Total 6 marks)

7.



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)

8. Make u the subject of the formula

$$D = ut + kt^2$$

u = ...

(Total 2 marks)

9.

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

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

(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)

10.

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

$P = 84$

$r = 6.7$

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

$a = \ldots\ldots\ldots\ldots\ldots\ldots..$

(3)

(b) Make r the subject of the formula

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

$r = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$

(3)
(Total 6 marks)

11. Make x the subject of

$$5(x - 3) = y(4 - 3x)$$

x = ...

(Total 4 marks)

12. $P = \dfrac{n^2 + a}{n + a}$

Rearrange the formula to make a the subject.

a =....................................

(Total 4 marks)

13. 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 $d = \sqrt{\dfrac{3h}{2}}$

h =...............................
(2)
(Total 4 marks)

14. $$\frac{x}{x+c} = \frac{p}{q}$$

Make x the subject of the formula.

$x =$................................

(Total 4 marks)

15. (a) Make n the subject of the formula $m = 5n - 21$

$n =$ ....

(2)

(b) Make p the subject of the formula $4(p - 2q) = 3p + 2$

$p =$ ....

(3)

(Total 5 marks)

16. (a) Factorise completely $3a^2 - 6a$

....

(2)

(b) Make q the subject of the formula $P = 2q + 10$

q = ...

(2)

(c) Expand and simplify $(y + 3)(y - 4)$

....

(2)

(d) Factorise $4p^2 - 9q^2$

....

(2)
(Total 8 marks)

17. (a) Simplify $(2x^4y^5)^3$

....

(2)

$$y = \frac{2pt}{p - t}$$

(b) Rearrange the formula to make t the subject.

$t =$ ....

(4)

(Total 6 marks)

18. Make b the subject of the formula $a = \dfrac{2 - 7b}{b - 5}$

....

(Total 4 marks)

19. $$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$u = 2\frac{1}{2}$, $v = 3\frac{1}{3}$

(a) Find the value of f.

....

(3)

(b) Rearrange $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

to make u the subject of the formula.

Give your answer in its simplest form.

....

(2)

(Total 5 marks)

20. Make m the subject of the formula $2(2p + m) = 3 - 5m$

$m = $ ....

(Total 3 marks)

21. 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)

22. Make a the subject of the formula $2(3a - c) = 5c + 1$

……………………..

(Total 3 marks)

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

$P = 84$
$r = 6.7$

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

$a =$ ……………………………

(Total 3 marks)

24. Rearrange $\dfrac{1}{u} + \dfrac{1}{v} = \dfrac{1}{f}$

to make u the subject of the formula.

Give your answer in its simplest form.

……………………………

(Total 2 marks)

1. (a) 8 2

$5 = 0.5x + 1$

M1 for $5 = 0.5x + 1$
A1 cao

(b) $y = \frac{1}{2}x + c$ 1

B1 for $y = \frac{1}{2}x + c$*, $c \neq 1$, oe*

(c) $x = 2y - 2$ OR
$x = 2(y - 1)$ 2

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

A1 for $x = 2(y - 1)$, $x = \frac{y-1}{0.5}$; $x = \frac{y-1}{\frac{1}{2}}$ *oe*

SC: B1 for $x = 2y - 1$

[5]

2. (a) 1700 3

$\pi \times 30 \times \frac{7.5^2}{3} - \pi \times 10 \times \frac{2.5^2}{3} = 1767 - 65$

M1 for either $\pi \times 30 \times \frac{7.5^2}{3}$ *or* $\pi \times 10 \times \frac{2.5^2}{3}$

M1 (dep) for difference

A1 1700 – 170

SC *B1 Using d instead of r, 6800 – 6808*

(b) $h = \sqrt{\dfrac{S^2 - 4\pi^2 d^4}{4\pi^2 d^2}}$ 3

$\dfrac{S}{2\pi d} = \sqrt{h^2 + d^2}$

$\left(\dfrac{S}{2\pi d}\right)^2 = h^2 + d^2$

M1 for correctly isolating $\sqrt{h^2 + d^2}$ *or* $h^2 + d^2$ *or* $h + d$ *or* kh^2 *or* kh
M1(indep) squaring both sides
A1

$h = \sqrt{\dfrac{S^2 - 4\pi^2 d^4}{4\pi^2 d^2}}$, $h = \dfrac{\sqrt{S^2 - 4\pi^2 d^4}}{2\pi\pi}$

$h = \sqrt{\left(\dfrac{S}{2\pi\pi}\right)^2 - d^2}$

(c) 1012.5 2

$\left(\dfrac{30}{20}\right)^2 \times 450$ or $450 \div \left(\dfrac{20}{30}\right)^2$

M1 for sight of correct SF^2 *including 4:9*
A1 1010 to 1013

[8]

3. (a) AG 3

$4a^2 - 4a + 1 - (4b^2 - 4b + 1) =$
$4(a^2 - b^2) - 4(a - b)$
$4(a - b)(a + b - 1)$

OR
$((2a - 1) - (2b - 1))((2a - 1) + (2b - 1))$
$(2a - 2b)(2a + 2b - 2)$

Expansion Method
M1 for a correct expansion of any one of the three terms
M1(dep) on an attempt to expand all 3 terms and show LHS = RHS
A1 fully correct algebra
RHS exp is $4(a^2 + ab - a - ba - b^2 + b)$
OR Factorisation Method
M1 for attempt to use difference of 2 squares on LHS
M1 for one bracket correctly simplified
A1 fully correct

(b) 3

Any 2 odd square numbers have the above form

If a and b are both even or odd then $a - b$ is even,
so $4(a - b)$ is a multiple of 8
If one of a,b is odd, then $a + b - 1$ is even,
so $4(a + b - 1)$ is a multiple of 8

B1 'any 2 square nos have the above form' (may be implied by sight of $(2a - 1)^2 - (2b - 1)^2$ in part (b))
B1 first reason
B1 second reason

SC B1 for $(2r + 1)^2 - (2r - 1)^2$
B1 for 8r

[6]

4. (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]

5. (a) 60 3

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

M1 $p = 1$ stated or used
M1dep $3w + 20 = 200$ oe
A1 cao

(b) $\dfrac{200p - 20}{3}$ 3

$200p = 3w + 20$
$3w = 200p - 20$

M1 for $200p = 3w + 20$ or $p = \dfrac{3w}{200} + \dfrac{20}{200}$
M1 $3w = 200p - 20$ or correct ft to isolate the w term
A1 for $\dfrac{200p - 20}{3}$ oe

(c) $\dfrac{4(3w+20)}{60-w}$ 4

$(3w + 20)(A + 12) = 200A$

$3wA + 36w + 20A + 240 \quad (= 200A)$

$36w + 240 = 3A\,(60 - w)$

or eg.

$36w + 240 = A\,(180 - 3w)$

Alternative for (c)

$\dfrac{A+12}{A} = \dfrac{200}{3w+20}$

$1 + \dfrac{12}{A} = \dfrac{200}{3w+20}$

$\dfrac{12}{A} = \dfrac{200}{3w+20} - 1$

$\dfrac{A}{12} = \dfrac{1}{\dfrac{200}{3w+20} - 1}$

$A = \dfrac{12(3w+20)}{180-3w}$

M1 for (3w + 20)(A + 12) = 200A

B1 for correct expansion of brackets

M1for isolating A terms and factorising; condone one arithmetic/sign slip in total during these two processes

A1 for $\dfrac{4(3w+20)}{60-w}$ *oe e.g.* $\dfrac{36w+240}{180-3w}$

M1 for $1 + \dfrac{12}{A} = \dfrac{200}{3w+20}$

A1 for $\dfrac{12}{A} = \dfrac{200}{3w+20} - 1$

M1 for $\dfrac{A}{12} = \dfrac{1}{\dfrac{200}{3w+20} - 1}$ *or 12(3w + 20) = A [200 − (3w + 20)]*

A1 $A = \dfrac{12(3w+20)}{180-3w}$ *oe*

[10]

6. (a) $x(x - 15) = 199.75$

$x^2 - 15x = 199.75$

$x^2 - 15x - 199.75 = 0$ 3

B1 for sight of $x - 15$ *or* $\frac{199.75}{x}$

B1 for $x(x - 15) = 199.75$

B1 for $x^2 - 15x - 199.75 = 0$ *following correct algebra*

SC: $x \times x - 15 = 199.75 \Rightarrow x^2 - 15x - 199.75 = 0$ *is 1/3*

(b) 23.5 or – 8.5 3

$$\frac{15 \pm \sqrt{225 - 4 \times 1 \times \quad 199.75}}{2}$$

Or

$(x - 7.5)^2 - 56.25 = 199.75$

$x - 7.5 = \pm \sqrt{256}$

M1 for correct substitution into formula, allow sign errors

A1 for 23.5

A1 for – 8.5

Or

M1 for $(x - 7.5)^2 - 56.25$

A1 for 23.5

A1 for –8.5

Or

$4x - 60x - 799 = 0$

$(2x - 4)(2x + 17) = 0$ $x = 23.5$ *or* -8.5

M1 for attempt *A1* *A1*

Trial and error: 1 solution B1

Other solution B2

[6]

7. (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*

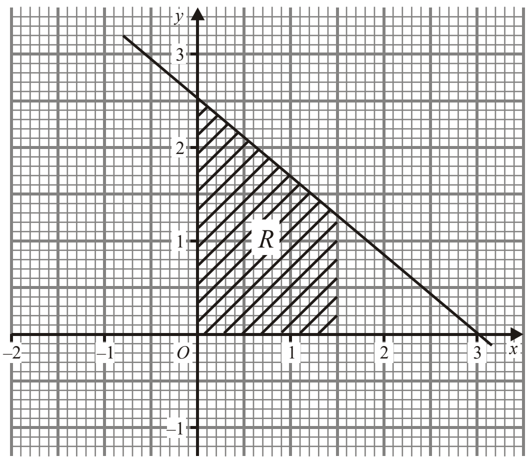
(b) 20 2

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

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]

8. $\frac{D - kt^2}{T}$ 2

$D - kt^2 = ut$

$u = \frac{D - kt^2}{T}$

B2 for $\frac{D - kt^2}{T}$ *oe*

(B1 for $\frac{D}{t} = \frac{ut + kt^2}{t}$ *or* $D - kt^2 = ut$

or one of two steps correct)

[2]

9. (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]

10. (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]

11. $5x - 15 = 4y - 3xy$
$5x + 3xy = 4y + 15$
$x(5 + 3y) = 4y + 15$
$x = \dfrac{4y+15}{5+3y}$ 4

M1 for expanding into four terms three of which are correct
M1(indep) for rearranging correctly to isolate x terms
M1(indep) for factorising x from 2 terms with one factor involving y
A1 cao for final answer $x = \dfrac{4y+15}{5+3y}$ oe

[4]

12. $(n + a)P = n^2 + a$
$nP + aP = n^2 + a$
$a(P - 1) = n^2 - nP$
$a = \dfrac{n^2 - nP}{P-1}$ 4

M1 $(n + a)P = n^2 + a$
M1 $nP + aP = n^2 + a$
M1 $a(P - 1) = n^2 - nP$ or $a(1 - P) = nP - n^2$
A1 for $a = \dfrac{n^2 - nP}{P-1}$ oe

[4]

13. (a) 12 600 or 1.26×10^4 2

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

(b) $d^2 = \frac{3h}{2}$ 2

$= \frac{2d^2}{3}$

M1 for squaring each side

A1 for $\frac{2d^2}{3}$ oe

[4]

14. $qx = p(x + c)$ 4

M1 for $qx = p(x + c)$ oe

$qx = px + pc$

M1 for $qx = px + pc$ oe

$qx - px = pc$

M1 for $x(q - p) = pc$ oe process

$x(q - p) = pc$

A1 for $\frac{pc}{q - p}$ oe

$= \frac{pc}{q - p}$

[4]

15. (a) $5n = m + 21$

$n = \frac{m + 21}{5}$ 2

M1 for $5n = m + 21$ or for attempt to divide three terms by 5

A1 $n = \frac{m + 21}{5}$ oe

(b) $4p - 8q = 3p + 2$
$p - 8q = 2$
$p = 8q + 2$ 3

M1 for $4p - aq$ or $\frac{3}{4}p + b$ where a is an integer and b is a number
M1 (dep) for taking one term correctly to LHS or RHS of expression
A1 $p = 8q + 2$ oe

[5]

16. (a) $3a(a - 2)$ 2

B2 for $3a(a - 2)$
(B1 for $3(a^2 - 2a)$ or $a(3a - 6)$ or 3a(linear expression in terms of a))

(b) ½ $(P - 10)$ 2

M1 for correctly isolating 2q or –2q correctly dividing both sides by 2 or for a correct second step which may follow an incorrect first step
A1 for ½ $(P - 10)$ oe

(c) $y^2 + 3y - 4y - 12 = y^2 - y - 12$ 2

B2 for $y^2 - y - 12$
(B1 for 3 out of 4 terms in $y^2 + 3y - 4y - 12$)

(d) $(2p + 3q)(2p - 3q)$ 2

M1 for $(2p \pm 3q)(2p \pm 3q)$ or $(2p)^2 - (3q)^2$
A1 for $(2p + 3q)(2p - 3q)$

[8]

17. (a) $8x^{12}y^{15}$ 2

B2
(B1 any two correct in a 3 term product)
(SC B1 for $8x^{12} + y^{15}$)

(b) $(p - t)y = 2pt$
$py - ty = 2pt$
$py = ty + 2pt$
$py = t(y + 2p)$

$t = \dfrac{py}{y+2p}$ 4

M1 eliminate fractions $(p - t)y = 2pt$

M1 $py - ty = 2pt$

M1 Collect terms in t on 1 side with all other terms on the other side $py = ty + 2pt$

A1 cao

[6]

18. $a(b - 5) = 2 - 7b$
$ab - 5a = 2 - 7b$
$ab + 7b = 2 + 5a$
$b(a + 7) = 2 + 5a$

$b = \dfrac{2+5a}{a+7}$ 4

M1 for $a(b - 5)$ or $ab - 5a$ or $ab - 5$
M1 for isolating ab and 7b on one side to get $ab + 7b$ oe
M1 for correctly factorising b from '$ab + 7b$' (term in ab must be present)

A1 for $b = \dfrac{2+5a}{a+7}$ or $b = \dfrac{-2-5a}{-a-7}$

[4]

19. (a) $\frac{1}{2\frac{1}{2}} + \frac{1}{3\frac{1}{3}} = \frac{1}{f}$

$\frac{2}{5} + \frac{3}{10} = \frac{1}{f}$

$\frac{7}{10} = \frac{1}{f}$

$= \frac{10}{7}$ 3

M1 $\frac{1}{2\frac{1}{2}} + \frac{1}{3\frac{1}{3}} = \frac{1}{f}$

M1 correct addition of the fractions to get $\frac{7}{10}$ *oe*

A1 for $\frac{10}{/}$ *oe*

(b) $\frac{1}{u} = \frac{1}{f} - \frac{1}{v}$

$\frac{1}{u} = \frac{v-f}{fv}$

$u = \frac{fv}{v-f}$ 2

M1 $\frac{1}{u} = \frac{v-f}{fv}$ *oe or* $vf + uf = uv$ *oe or* $\frac{1}{u} = \frac{f-v}{fv}$ *or*

$u = \frac{1}{\frac{v-f}{fv}}$ *or* $u = \frac{1}{\frac{1}{f} - \frac{1}{v}}$

A1 $u = \frac{fv}{v-f}$ *or* $u = \frac{-fv}{f-v}$

[5]

20. $m = \dfrac{3-4p}{7}$ 3

$4p + 2m = 3 - 5m$
$2m + 5m = 3 - 4p$

M1 for expanding or splitting into 4 correct terms
M1 (indep) rearranging 4 terms correctly to isolate m terms
(A1 for $m = \dfrac{3-4p}{7}$ *oe fully simplified)*

[3]

21. (a) 8 2

$5 = 0.5\,x + 1$

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 $\dfrac{x}{2}$

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

SC: B1 for $x = 2y - 1$

[4]

22. $a = \dfrac{7c+1}{6}$ 3

$6a - 2c = 5c + 1$
$6a = 5c + 2c + 1$

M1 for either $6a - 2c = 5c + 1$ *OR* $3a - c = \dfrac{5c+1}{2}$ *oe RHS*
M1 ft (indep) for correct process to isolate term in a
A1 cao

[3]

23. 24.8 3

$84 = 6.7\pi + 2 \times 6.7 + 2a$
$2a + 13.4 = 62.95\ldots.$
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]

24. $\frac{1}{u} = \frac{1}{f} - \frac{1}{v}$

$\frac{1}{u} = \frac{v-f}{fv}$

$u = \frac{fv}{v-f}$ 2

M1 $\frac{1}{u} = \frac{v-f}{fv}$ *oe or* $vf + uf = uv$ *oe or* $\frac{1}{u} = \frac{f-v}{fv}$ *or*

$u = \frac{1}{\frac{v-f}{fv}}$ *or* $u = \frac{1}{\frac{1}{f} - \frac{1}{v}}$

A1 $u = \frac{fv}{v-f}$ *or* $u = \frac{-fv}{f-v}$

[2]

1. Paper 4

In part (a) many candidates correctly substituted $y = 5$ into the equation but were then unable to solve this correctly. Some substituted 5 for x instead of y. Part (b) was answered poorly. Many tried to rearrange the equation or simply wrote it in a different way, e. g. $y = 0.5x + 1$. Dealing with the $\frac{1}{2}$ proved difficult in part (c) and even successful candidates tended to write $\frac{y-1}{\frac{1}{2}}$ rather than $2(y - 1)$. Few candidates rearranged the equation correctly and often no working was shown so no mark could be awarded for a correct step. Some candidates simply interchanged x and y in the equation.

Paper 6

The presence of the half as the coefficient of x caused more problems than it should have. A common answer to part (a) was 9, which was obtained by multiplying 5 by 2 and then subtracting 1. A similar process was carried out in many cases for part (c), where the answer of $x = 2y - 1$ was very common.
There were many correct answers to part (b), although some candidates thought that they had to write the same equation in an alternative fashion, giving, for example, the response $2y = x+2$.

2. The first part was competently done with many candidates scoring full marks. Some thought they could take a short cut by using 20cm as the height.
Answers for part (b) varied considerably, but the general standard of algebra was poor. Common errors were as follows:

$$\sqrt{h^2 + d^2} = h + d$$

$$S - 2\pi d = \sqrt{h^2 + d^2}$$

$$S^2 = 2\pi d(h^2 + d^2)$$

Some candidates produced a correct formula for h, but went on to 'simplify' the square root, writing

$$\sqrt{\frac{S^2}{(2\pi d)^2} - d^2} = \frac{S}{2\pi d} - d$$

Part (c) was poorly answered except by candidates who knew that the scale factor for areas was the square of the scale factor for lengths, or used the corresponding result for the areas of similar shapes.

3. Part (a) once again exposed weaknesses in algebra. There were first of all the candidates who thought that expanding the square meant just squaring the first term and then squaring the second term. Further, the square of $2a$ is $2a^2$ and the expansion of the left-hand side yields $4a^2 - 4a + 1 - 4b^2 - 4b + 1$.
Candidates also found difficulty with the right hand side. Some could not deal with the 4 correctly, but the major error from those that knew something, was to get the sign of the b term wrong.
A few candidates saw the connection between this part and part (b). Only the very best were able to reason why the expression on the right hand side should be a multiple of 8, but many managed to get partial credit by arguing that it was a multiple of 4. An interesting approach, which appeared on occasions, was to consider the difference between consecutive odd squares. This also gained partial credit as by arguing that any two odd squares are connected by a sequence of consecutive odd square numbers, a candidate could have obtained full marks.
It was disappointing to see so many candidates writing $(2r - 1)^2 - (2r - 1)^2$ where clearly they had not understood the basic rule of algebra, that the same letter in an algebraic expression always carries the same value.

4. 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.

5. In part (a), few candidates started the solution by stating $p = 1$ but partway through a majority of solutions, the term '200p' became '200' and the correct answer of 60kg was obtained. There were many good solutions presented to part (b) which showed that candidates had a good understanding of a two-stage rearrangement. Part (c), as expected, caused candidates more difficulty. Many grade A candidates correctly eliminated the fractions and expanded the resulting brackets but a significant number then failed to deal with the terms in A correctly. Many weaker candidates, if they attempted this final part, tried to obtain a numerical value for A.

From Questions 12 onwards all questions are graded A or A. Weak grade C candidates rarely scored any marks in these questions. The comments made from this point onwards are generally based on the performance of grade B and higher grade candidates.*

6. art (a) was poorly done as it was clear that many candidates did not realise that a construction of an algebraic expression was first required, followed by setting the algebraic expression equal to 199.75. A good number decided to solve the equation and then use the positive value of x to show that it satisfied the equation.
In part (b), too many candidates tried to solve the quadratic equation by trial and improvement. Of those that used the formula a great number got the sign of c wrong and ended up with a negative sign under the square root sign. Some candidates, who used the formula to get the two solutions, rejected the negative value.

7. **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.

8. In this changing the subject of the formula question, about 50% of candidates obtained the correct solution with nearly 20% of candidates making one correct step in the process.

9. 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.

10. 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.

11. Many candidates gained marks for expanding the brackets, fewer for rearranging the equation, and fewer still for factorising x. Common misunderstandings were $5x + 3x = \dfrac{4y+5}{y}$ and

$x = \dfrac{4y + 15 - 3xy}{5}$.

12. **Specification A**

Many candidates were able to gain at least 1 mark for cross multiplying by $n + a$, but some of these did not fully multiply by P, common errors here were $nP + a = n^2 + a$ and $n + aP = n^2 + a$. Only the best candidates could now rearrange and factorise the expression accurately- sign errors were very common.

Specification B

Candidates found this a very demanding question with only approximately 5% supplying a fully correct solution. Disappointingly, only about 30% of all candidates were able to take the correct first step of multiplying through by $(n + a)$. The majority of these candidates were able to go on and correctly multiply out $P(n + a)$ but the next required step of isolating the terms containing a was beyond the majority. A significant number of candidates tried to cancel as their first step and so gained no marks.

13. **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.

14. This type of question has been asked frequently in the past few examinations and still proves to be a problem for many candidates. Those with some idea understand they have to clear fractions and many then go on to collect like terms. At this point they do not spot the need to factorise the x terms and thus end up with half marks. A common error when clearing fractions was to write $qx = px + c$. Surprisingly, some of these candidates went on to complete their task in the form $x = \frac{c}{q-p}$.

15. In part (a), the most successful candidates were those who adopted a step-by-step approach, taking the 21 across first and then dividing by 5, but there were many who were confused by the order of these operations. Sign errors and partial division were common mistakes, as was the method of merely swapping the n and m. 21/5 = 4.1 was also a common error.

16. Part (a) was answered well by about half the candidates, and many were able to achieve a mark for partially factorising either the 3 or the a. Common errors were $3a(a – 3)$ and $3a(a + 2)$

Part (b) was done well by many candidates. Candidates should be encouraged to show all stages in an algebraic manipulation. A significant number of candidates simply wrote down their final answer (often incorrectly) without showing any working. Many candidates were confused about the order of operations and/or the nature of the operations. Typical first line errors were

$\frac{P}{2} = q + 10$ $2q = P + 10$ and $q = 2P + 10$.

Part (c) was done well by the majority of candidates. Most candidates were able to expand the brackets with obtain at least three of four correct terms. Common errors were $–4y + 3y = –7y$, $y \times y = 2y$ and $(y + 3)(y – 4) = y^2 + 3y – 4y – 1$

In part (d), only the best candidates were able to achieve both marks for factorising the expression. Common errors amongst those candidates who showed some understanding of what was required were $(2p – 3q)(2p – 3q)$and $(2p)^2 – (3q)^2$.

17. (a) Good candidates generally scored full marks. The most common errors which at least scored 1 mark were $2x^{12}y^{15}$ and $6x^{12}y^{15}$. There were many poor responses with commonly seen.

(b) This proved a tough challenge for most candidates although questions of this type have become reasonably frequent over the past few years. The crucial stage comes with the collection of all the terms in t on one side followed by factorising those terms. Sadly many candidates did not even get the first stage correct, with expressions such as $py - t$ very common as the first step, usually from the misuse or absence of brackets.

18. Only the best candidates were able to score full marks in this question, but many were able to score 1 mark for clearing the fraction. A common error here was $ab - 5$. Of those who were able to clear the fraction successfully, few realized that they needed to rearrange the equation to isolate the terms in b (many of those who did made errors in signs, e.g. $ab - 7b$). Having got to '$ab + 7b$' few candidates went on to factorise the b, many simply divided 'selectively' by a, e.g. $ab + 7b$ to get $b + 7b = \dfrac{2+5a}{a}$. A small number of candidates simply interchanged the letters and sometimes the signs to get $b = \dfrac{2-7a}{a-5}$ or $b = \dfrac{2+7a}{a+5}$ or (each scoring 0 marks).

19. Many candidates gained one mark in part (a) for a correct substitution but very few were able to progress any further. Most went on to add $2\frac{1}{2}$ to $3\frac{1}{3}$ and then gave either $5\frac{5}{6}$ or the reciprocal of it as the final answer. Some candidates attempted to use a common denominator of $2\frac{1}{2} \times 3\frac{1}{3}$ but frequently made errors in their calculations. A small number of candidates converted the fractions to $\frac{4}{10}$ and $\frac{3}{10}$ respectively and obtained $\frac{7}{10}$ easily but some then forgot to invert.

Many candidates showed considerable working which was often poorly set out and difficult to follow. Only the very best candidates were successful in part (b). Most were unable to manipulate the terms correctly. Some simply inverted everything and $u + v = f$ became $u = f - v$. Others attempted to clear the fractions but forgot to multiply all the terms by f (or v or u). Those who managed to get to $1/u = 1/f - 1/v$ sometimes went on to gain one mark for $u = 1/(1/f - 1/v)$.

20. Most candidates expanded the bracket correctly. Sign errors were common in rearranging the subsequent four terms. Those candidates who started by dividing by 2 (rather than expand the bracket) rarely went on to get the correct answer.

21. 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 $x = 2y - 1$

22. A significant minority of candidates left their answers as $6a =\ldots$ rather than reduce it to $a =\ldots$
The majority of candidates gained some credit in this question.

23. 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.

24. This proved to be very tough except for the very best candidates.

Many got to $\frac{1}{u} = \frac{1}{f} - \frac{1}{v}$ but then were not able to progress in any meaningful way.