How many terms of the series -7 -9 -11 &c amount to 200?

$$S = \{2a + (n-1)d\}\frac{n}{2}$$

$$200 = \{-14 + (n-1)2\}\frac{n}{2}$$

$$200 = \{-14 + 2n - 2\}\frac{n}{2}$$

$$200 = (2n - 16)\frac{n}{2}$$

$$18400 = 2n^2 - 16n$$

$$2n^2 - 16n = 18400 \text{ or}$$

$$n^2 - 8n = 9200.$$

Complete Square we have

$$n^2 - 8n + (4)^2 = 9200 + 16 = 9216$$

Extract Square root of both

$$n - 4 = \pm 96$$

$$n = 100$$

Ans: 100.

Find the area of a court 250 ft. long by 200 ft broad, (1) by the senary (2) by the duodenary scale.

250 den: = 1054 sen: = 418 duod:

200 den: = 532 sen: = 148 duod:

$$\begin{array}{r} 1054 \\ 532 \\ \hline 2152 \\ 3250 \\ \hline 5442 \\ \hline 10232152 \end{array}$$

area in senary

18t
1/4 8
11t8
6 e 4
18t
24 e 28 area in Quad.

Ans 1023252 Lon: 24 e 28 Quad. 3(0009

A's money with ½ of B's would be ⅓ as much again as before; and if 2s be taken from B's present sum and added to A's the latter amount will be ⅓ of the former. What had they each at first?

Let x = A's money in shillings
" y = B's " " "

Then $x + \frac{1}{2}y = 1\frac{1}{3}(x)$

And $\frac{1}{2}y + 2 = \frac{1}{3}(1\frac{1}{3}x - 2)$

$x - \frac{4}{3}x + \frac{1}{2}y = 0$

$\frac{1}{2}y + 2 - \frac{4}{9}x = -\frac{2}{3}$

(1) $6x - 8x + 3y = 0$
(2) $9y + 36 - 8x = 12$

(1) $-2x + 3y = 0$
(2) $-8x + 9y = -48$

Mult. (1) by 4 we have $-8x + 12y = 0$ (1)
$-8x + 9y = -48$

By Subt. $3y = 48$

$\therefore y = 16$

Substitute this value of y in II

we have $-2x + 48 = 0$

$-2x = -48$

$\therefore x = 24$

Ans: £ 24 Bs 16s.

A servant agrees with his master for

8 £ a year and a livery, but was turn-

ed away at the end of 7 months and

received £2 . 13s . 4d and his livery

what was it worth?

Let x = the worth of the livery in £

Then $\frac{7}{12}(8+x) = 2\frac{2}{3} + x$

$\frac{7}{12}(8+x) = \frac{8}{3} - x$

$56 + 7x = 32 + 12x$

$-5x = -24$

$5x = 24$

$\therefore x = \frac{24}{5} = 4\frac{4}{5} = 4 . 16$

Ans £ 4 . 16s.

A person makes 20 lbs. of tea at 4s. 6d. by mixing three kinds at 3s. 6d., 4s. 6d. and 5s: how can this be done?

Let x = quantity at 3s 6d (in lbs)
y = " " 4s. 6d
& I = " " 5s

(1) $x+y+z=20$
(2) $3\frac{1}{2}x+4\frac{1}{2}y+5z=20\ (3\frac{3}{4})$

1 $x+y+z=20$
2 $7x+9y+10z=190$
Multiply 1 by 10 $\therefore 10x+10y+10z=200$
2) $7x+9y+10z=190$
By Subt. $3x+y=10$ Whence

$x=1\ y=7\ z=12$ a
$x=2\ y=4\ z=14$ a
$x=3\ y=1\ z=16$.

Ans 1, 7, 12 a 2. 4. 14 a 3. 1. 16.

A person bought 38 sheep a 5£;
but having lost a certain number, n.
of them, he sold the remainder for
n shillings a head more than they
cost him, and so gained upon the
whole 16s: how many sheep did he lose?

38) 57 (£1 . 10 s. = 30 s.
38
19
20
38) 380 (10
380

n = the no. lost

Then (38 − n) (30 + n) = 1156 − 5 f. 16

1140 + 8n − n² = 1156

− n² + 8n = 16

n² − 8n = −16

n² − 8n + 4² = −16 + 16 = 0

n − 4 = 0

∴ n = 4

Ans 4

£100 stock in the 3 per cents is sold for £91 . 13 s; how much can be bought for £510, allowing ⅛ per cent upon the stock bought

91 3/4 + 1/8 = 91 7/8

As 91 7/8 : 540 :: 100 :

540 × 100 × 8 / 1 × 1 × 735 = 28800 / 49 = 587 37/49

Ans: 587 37/49

What is the present worth of £2035.15s.

due in 2yrs. 5½ mths. at 4½ per cent.

$\frac{29\frac{1}{2}}{12} * 4\frac{1}{2} = \frac{59}{2} * \frac{1}{12} * \frac{9}{2} = \frac{177}{96} = 1\frac{81}{96}$

£ £ £

As 1 1 1 1/6 : 100 :: 2035 3/4

$\frac{100 * 8143 * 16}{1 \quad 4 \quad 177} = \frac{325720}{177}$

£ s d

Ans: 1832 19 6 $\frac{82}{177}$

If a tradesman mark his goods 20

per cent. above the cash price what

ready money would he take for

an article marked 26s.?

As 120£ : 100£ :: 13/10 £.

$\frac{100}{120} * \frac{13}{10} = \frac{13}{12} = \frac{£\ s\ d}{1\ 1\ 8}$

12

£ s d

Ans: 1 1 8

A and B trade with different sums.

A gains £200. B loses £50 and now

A's stock : B's :: 2 : ½ but if A had gain

ed £100 and B lost £85, their stocks would have been as 15 : 3¼; find the original stock of each.

Let x = As

And y = Bs

Then $x+200 : y-50 :: 2 : \frac{1}{2}$

$x+100 : y-85 :: 15 : 3\frac{1}{4}$.

① $\frac{x+200}{y+50} = \frac{2}{\frac{1}{2}}$

② $\frac{(x+100)}{y-85} = \frac{15}{3\frac{1}{4}}$

① $x+200 = 4y-200$

② $13x+1300 = 60y-5100$

① $x-4y = -400$

② $13x-60y = -6400$

Multiply ① by 13 we have

① $13x-52y = -5200$

② $13x-60y = -6400$

By Subt. $8y = 1200$

$\therefore y = \frac{1200}{8} = \underline{150}$ £ Bs

Substitute this value of y in ①

$x-600 = -400$

$\therefore \underline{x = 200}$ £ As

Ans: £200. £150.

By selling an article for 10s. the seller loses 5 per cent; what will be the loss or gain when sold for 12s. 6d., and

what was its prime cost?

As $\frac{£}{95} : \frac{£}{100} :: £\frac{1}{2}$ or 10 s.

$$\frac{\overset{10}{\cancel{100}}}{\underset{19}{\cancel{95}}} \times \frac{1}{2} = \frac{10}{19} = \underline{10 \text{ s } 6\frac{6}{19}\text{d prime cost}}$$

As $\frac{£10}{19} : £\frac{5}{8} :: \frac{£}{100} :$

$$\frac{5}{\cancel{8}_{4}} \times \frac{\overset{10}{\cancel{100}}}{1} \times \frac{19}{\underset{2}{\cancel{10}}} = \frac{475}{4} = \underline{£118\frac{3}{4} :: \text{gain per cent} = 18\frac{3}{4}}$$

Ans: $18\frac{3}{4}$ $\underline{\text{s } 10 \text{ d } 6\frac{6}{19}}$

A farmer gave for a horse a bill of £156 due 8 months hence, at 4½ per cent, and sold him at once for £180. required his gain per cent.

$$\frac{\cancel{4}}{\cancel{8}_{2}} \times \frac{\cancel{9}^{3}}{\cancel{12}_{3}} = 3$$

As $\frac{£}{103} : \frac{£}{100} :: \frac{£}{156} :$

$$\frac{100 \times 156}{103} = \frac{15600}{103} = £151\frac{47}{103}$$

$$\begin{array}{r} 180 \\ 151\frac{47}{103} \\ \hline 28\frac{56}{103} \end{array}$$

As $\frac{£}{151\frac{47}{103}} : \frac{£}{28\frac{56}{103}} :: \frac{£}{100} :$

$$\frac{\cancel{2}\,\cancel{4}\,\cancel{5}}{\cancel{1}\,\cancel{8}\,\cancel{1}} \times \frac{\cancel{1}\,\cancel{0}\,\cancel{0}}{1} \times \frac{\cancel{1}\,\cancel{0}\,\cancel{3}}{15600} = \frac{240}{13} = 18\tfrac{6}{13}$$

$$\cancel{2}\,\cancel{2}$$
$$13$$

Ans: $18\frac{6}{13}$

A labourer dug two trenches one 6 yds longer than the other, for £17. 16 s, and the digging of each cost as many shillings per yd as there were yds in its length: find the length of each.

Let x = length of the longer
Then $x-6$ = " " shorter.

$$(x)(x)+(x-6)(x-6)=356=\pounds 17.16.$$

$$x^2+x^2-12x+36=356$$

$$2x^2-12x=320$$

$$x^2-6x=160$$

$$x^2-6x+(3)^2=160+9=169$$

$$x-3=\pm 13$$

$$\therefore x=16 \text{ length of longer}$$

$$\therefore 10=\text{length of shorter.}$$

Ans: 16yds, 10yds.

A person dies worth £13.000: some of this he leaves to a charity, and twelve times as much to his eldest son, whose share is half as much again as that of his two brothers, and two thirds as much again as that of each of his 5 sisters: find the amount of the bequest to the charity.

Let x = the amt. of the bequest to the charity

Then $12x$ = eldest son's share

$\frac{2}{3}(12x)$ = share of each of his brothers

and $\frac{3}{5}(12x)$ = " " sisters

$$x + 12x + \frac{2}{3}(12x)\,2 + \frac{3}{5}(12x)\,5 = 1300$$

$$15x + 180x + 240x + 540x = 19500$$

$$975x = 195000$$

$$\therefore x = \frac{195000}{975} = 200$$

Ans: £200.

A person bought cloth for £12: had he had bought one yard less for the same money, each yard would have cost him 1s. more: how many yards did he buy?

Let x = the no. of yards he bought

Then $\frac{£12}{x}$ or $\frac{240s.}{x}$ = cost price

And $\frac{240}{x-1} = \frac{240}{x} = 1$

$240x - 240x + 240 = x^2 - x.$

$x^2 - x = 240$

$x^2 - x + \left(\frac{1}{2}\right)^2 = 240 + \frac{1}{4} = \frac{961}{4}$

$x - \frac{1}{2} = \pm\frac{31}{2}$

$\therefore x = 16$

Ans: 16yds.

A flagstaff is sunk in the ground one sixth part of its lenght: the flag occupies 2 feet, and the remainder of the staff is three quarters of its whole length. Required its whole length.

Let x = the height of the flagstaff.

Then $\frac{1}{6}x$ = is in the ground.

And 2 ft = length occupied by the flag.

$\frac{3x}{4}$ = remainder

$\frac{1x}{6} + 2 + \frac{3x}{4} = x$

$2x + 24 + 9x = 12x$

$-x = -24$

Changing signs

$x = 24$

Ans: 24 ft.

Out of £5000, a person leaves £20 to an old servant, and the remainder among three societies A, B, and C, so that B may have twice as much as C, and A three times as much as B: how much does each receive?

Let x = the money given to C.

Then $2x$ = " " B

And $6x$ = " " A

$£5000 - (x + 2x + 6x) = 20£$ - Money given to servant

$5000 - 9x = 20$

$-9x = -4980$

Changing signs

$9x = 4980$

$\therefore x = \frac{4980}{9} = \underline{553\frac{1}{3}\ £s}$

$\therefore 1106\frac{2}{3} = £s$

$\underline{+\ 3320 = £s}$

$\underline{\text{Ans: } £3320, £1106\frac{2}{3}, £553\frac{1}{3}.}$

A person bought a chaise, horse, and harness for £60; the horse cost twice as much as the harness, and the chaise half as much again as the horse and harness: what did he give for each?

Let x = the cost of the horse.

Then $\frac{1}{2}x$ = " harness

And $\frac{3}{2}x + \frac{1}{2}x$ = " chaise.

$$x + \frac{1}{2}x + \frac{3}{2}x + \frac{1}{2}x = £60$$

$$x + \frac{1}{2}x + \frac{3}{2}x + \frac{3}{4}x = 60$$

$$4x + 2x + 6x + 3x = 240$$

$$15x = 240$$

$$\therefore x = \underline{16£}$$

∴ Chaise cost £36 horse 16 & harness 8

Ans: £36; £16; £8

The fore-wheel of a carriage makes

6 revolutions more than the hind wheel

in 120 yds. and the circumferance of one

is a yard less than that of the other:

find that of each.

Let x = circumference of the hind wheel.

Then $x-1$ = circumference of the other.

$$\frac{120}{x-1} = \frac{120}{x} = 6$$

$$120x - 120x + 120 = 6x^2 - 6x$$

$$6x^2 - 6x = 120$$

$$x^2 - x = 20$$

Completing the square we have

$$x^2 - x + \left(\frac{1}{2}\right)^2 = 20 + \frac{1}{4} = \frac{81}{4}$$

Extracting Sq: Root

we have $x - \frac{1}{2} = \pm\frac{9}{2}$

$$\therefore x = 5$$

Ans: 4 yds and 5 yds.

Having £5 to give away among a certain number of persons, I find that by giving 3s to each man and 1s to each woman, I shall have 1s too little, but that, by giving 2s. 6d to each man and 1s. 6d to each woman I may distribute the sum exactly. How many men and women were there?

Let x = no. of men

And y = " women.

$(x \times 3) + (y \times 1) = 46$

$(x \times 2\frac{1}{2}) + (y \times 1\frac{1}{2}) = 45$

(1) $3x + y = 46$

(2) $5x + 3y = 90$

Multiply (1) by 3 we have

(1) $9x + 3y = 138$

(2) $5x + 3y = 90$

By Subt. $4x = 48$

$\therefore x = \frac{48}{4} = \underline{12 \text{ men}}$

Substitute this value of x in (1)

we have $36 + y = 46$

$\therefore y = \underline{10 \text{ women}}$

Ans. 12; 10.

Bought cloth at 9 months credit for 21s. per yard; how much per yd. should I be allowed for present payment, interest being reckoned at 4 per cent per annum?

$\frac{3}{\frac{9}{12}} * \frac{4}{1} = 3£$

As $103 : 100 :: £ : £$

$\frac{100}{103} * \frac{21}{20} + \frac{105}{103} = £\ 1.\ 0.\ 4\frac{68}{103}$

£ s. d

1 . 1 . 0

1 . 0 . 4 $\frac{68}{103}$

0 . 0 . 7 $\frac{35}{103}$

Ans: $7\frac{35}{103}$.

A legacy of £1500 is left to 3 individuals in the proportion of 1. 2. and 3. find the sums received by each after deducting the legacy duty of 10 per cent.

Their shares are $\frac{1}{6}$ $\frac{1}{3}$ and $\frac{1}{2}$

$\frac{1}{6}$ of 1500 $= \frac{1}{6} \times \frac{250}{1500} = £250$

$\frac{1}{3}$ of 1500 $= \frac{1}{3} \times \frac{500}{1500} = £500$

$\frac{1}{2}$ of 1500 $= \frac{1}{2} \times \frac{750}{1500} = £750$

Deduct duty,

$\frac{250}{100} \times \frac{10}{1} = 25 \therefore 250 - 25 = £225$

$\frac{500}{100} \times \frac{10}{1} = 50 \therefore 500 - 50 = £450$

$\frac{750}{100} \times \frac{10}{1} = 75 \therefore 750 - 75 = £675$

Ans: £225; £450; £675.

Simplify the conditions under which the expression

$x^3 + Bx^2y + Cxy^2 + Dy^3 + Ex^2 + Fxy + Gy^2 + Hx + Jy + K$ (. $x + \frac{1}{3}By + \frac{1}{3}E$

shall be a perfect cube.

x^3

$Bx^2y + Cxy^2 + Dy^3$

$3x + \frac{1}{3}By$ | $3x^2$ | $Bx^2y + Cxy^2 + Dy^3$

$+ Bxy + \frac{1}{9}By^2$

$3x^2 + Bxy + \frac{1}{3}By^2$ | $Ex^2 + Fxy + Gy^2 + Hx + Jy + K$

$3x + By + \frac{1}{3}E$ | $3x^2 + 2Bxy + \frac{1}{3}By^2 + Ex + \frac{1}{3}BEy + \frac{1}{9}E^2$ | $Ex^2 + \frac{2}{3}BExy + \frac{1}{9}BE^2y^2 + \frac{1}{3}E^2x + \frac{1}{27}BE^3y + \frac{1}{9}E^3$

$3x^2 + 2Bxy + \frac{1}{3}B^2y^2 + Ex + \frac{1}{3}BEy + \frac{1}{9}E^2$

Ans. $B^2 = 3C$, $B^2E = 9G$, $E = 3H$, $BE^2 = 9J$, $E^3 = 27K$.