

Ratio



Ratio

A **ratio** is a way of dividing or splitting quantities. Although ratios can be represented as a fraction we often use a colon (:) to separate the different quantities in a ratio.

A ratio of 2 : 3 means that for every 2 units of the first quantity we use 3 units of the second quantity. Therefore if we have a ratio of 2 : 3 it is exactly the same ratio as 4 : 6 or 10 : 15.

Ratios can be simplified if we can find a common factor that divides into all the quantities.

The ratio 10 : 15 can be simplified by dividing through by the common factor of 5 giving the ratio 2 : 3.

The units for ratios should always be the same. If we are mixing liquid in the ratio 1 : 5 it does not matter if it is 1 mL to 5 mL or 1 L to 5 L.

We can also divide a quantity into a given ratio.

Consider: Split \$24 into the ratio 3 : 5

We begin by adding the 3 and 5 to get 8 parts.

Therefore the \$24 is to be split into $\frac{3}{8}$ and $\frac{5}{8}$.

$$\text{So } \$24 \times \frac{3}{8} = \$9$$

$$\text{and } \$24 \times \frac{5}{8} = \$15$$

One person receives \$9 and the other person \$15.



Ratios are meant to simplify problems, so we don't usually have any decimals in a ratio and the ratio is expressed in its simplest form.



Always check that the final quantities total the original amount.
In this case $\$9 + \$15 = \$24$.



Example

Simplify the ratios.

a) 18 : 30



a) We identify the highest common factor of 6 and divide both 18 and 30 by 6.

$$18 : 30 = 3 : 5$$

Alternatively we can simplify using our calculator by entering the ratio as a fraction, i.e.

Casio 9750

1 8 a/b/c 3 0 EXE

TI-84 Plus

1 8 ÷ 3 0 MATH 1

ENTER

Therefore 18 : 30 simplifies to 3 : 5

b) 100mL : 3L Give your answer with the same units.

b) We convert to the same units (mL)
i.e. 100 : 3000.

We then divide by the highest common factor of 100 and 3000 which is 100 to get the simplified ratio 1 : 30.



Achievement – Simplify each ratio as much as possible. The final ratio should consist of whole numbers with the same units. Units should not be given as part of the answers.

226. $2 : 4$

227. $0.5 : 8$

228. $17 : 51$

229. $18 : 27$

230. $64 : 4$

231. $200 : 500$

232. $6 : 8 : 20$

233. $12 : 27 : 9$

234. $15 \text{ m} : 25 \text{ m}$

235. $100 \text{ mL} : 5 \text{ L}$

236. $0.5 \text{ m} : 3 \text{ m}$

237. $8 : 12 : 20$

238. $20 : 12 : 4 : 2$

239. $50 \text{ g} : 1.5 \text{ kg}$

240. $10 \text{ mm} : 1 \text{ km}$

241. $450 \text{ kg} : 1.5 \text{ T}$

Find the unknown variable.

242. $2 : 7 = 10 : w$

243. $4 : 0.5 = x : 18$

244. $18 : 7 = 6 : y$

245. $3 : 9 = 4 : z$

Share each quantity in the given ratio.

246. Share \$32 in the ratio $3 : 5$

247. Split 40 L in the ratio $15 : 5$

248. Divide \$128 in the ratio $35 : 55$

249. Divide 5 L in the ratio $19 : 1$

250. Split 5.2 m in the ratio $3 : 6 : 4$

251. Split \$35.80 in the ratio $5 : 3 : 8 : 4$

252. Divide \$17.60 in the ratio $3 : 5$

253. Divide \$143 in the ratio $6 : 5 : 2$

254. Two students work after school to clear a building site. Alysia works a total of 15 hours and Barbara works 10 hours. They get paid \$240 in total. How much should each student get?

255. Three friends Clare, Dennis and Elliot contribute \$16, \$12 and \$20 respectively towards the cost of an antique. They then sell the antique for a profit of \$80. How much profit should each friend get?

256. Two people enter into a partnership. One contributes \$20 000 and the other \$30 000. How should a profit of \$8500 be shared between them?

257. One person puts in \$2160 and another \$900 as part of an investment. How should a profit of \$680 from the investment be shared between them based on their contributions?

258. The price of a cinema ticket for a child compared to an adult can be represented by the ratio 4 : 5. If an adult pays \$18.75 for a ticket what would a child pay?

260. A farmer has a 2 : 7 ratio of cows to sheep on his property. If he was to sell 42 sheep, how many cows would he have to sell to keep the same ratio?

262. It is the first day of Deeana's holidays and she has a number of things to do prior to leaving on her Australian holiday. Use ratios to solve Deeana's problems.

- a) Deeana needs to "shock dose" the swimming pool with chlorine. The container says that for a 9000 L pool she should add 200 g. What dose should she add for their 60 000 L pool?

- b) Her neighbour has to add 1.5 kg of chlorine to their pool. How big a pool must she have?

- c) Deeana's friend Crystal has asked her to purchase some Australian clothes. The ratio of Australian money to New Zealand money is A \$0.825 : NZ \$1. How much Australian money will Crystal's NZ \$300 equate to?

- d) A fashion outfit cost A \$185. How much is this in New Zealand dollars?

- e) To get to Crystal's place Deeana uses her motorcycle. Her bike requires 50 mL of oil to be added for every 2 litres of petrol. How much oil should she add to 6.5 L of petrol?

259. A recipe has a ratio of water to milk of 3 : 2. If the recipe requires a total of 2.6 litres of liquid, how many litres of water is required?

261. A fertiliser comprises potash and super in the ratio 7 : 12. How much potash does 152 kg of fertiliser contain?

- f) The map of Auckland is at a scale of 10 mm for every 1 km of real distance. Deeana estimates that it is 7.5 cm to Crystal's place on the map. How far must she travel on her motorcycle?

- g) Australia won 16 gold Olympic medals in 2000. The population of New Zealand was 3.8 million and that of Australia was 19.5 million. How many gold medals should NZ have won.



**Example**

A clothing store sells three different sizes of board shorts, S(mall), M(edium) and L(arge). They always purchase them in the ratio of 2 : 3 : 4. If the store purchases 18 M(edium) pairs of board shorts how many did they purchase altogether?



Let x = S size shorts and y = L size shorts.

$$\frac{S}{M} = \frac{2}{3} = \frac{x}{18}$$

$$\text{so } x = 12$$

i.e. 12 S(mall) pairs of shorts

$$\text{and } \frac{M}{L} = \frac{3}{4} = \frac{18}{y}$$

$$\text{so } 3y = 72$$

$$y = 24$$

i.e. 24 L(arge) pairs of shorts.

Total sold = $12 + 18 + 24 = 54$ pairs of shorts

**Example**

The total number of Year 9 students who sign up for volleyball is 57 and the ratio of girls to boys is 4 : 15. How many boys would have to choose another sport and leave volleyball for the ratio of girls to boys to be 4 : 11.



Number of boys who initially sign up for volleyball

is $\frac{15}{19} \times 57 = 45$ boys, so there must be 12 girls.

The required ratio of girls to boys is 4 : 11,

so $\frac{11}{15} \times 45 = 33$, which is the number of boys required.

Hence $45 - 33 = 12$ boys would need to choose another sport.



Merit/Excellence – Answer the following questions.

263. The ratio of three different coffees sold in a café are 2 : 4 : 5 (latté, cappuccino and flat white). If the café sells 48 cappuccino's in one day how many coffees did they sell in total?

264. The total number of people at a night class course is 54 and the ratio of men to women is 15 : 12. How many men would have to leave the course if the required men to women ratio had to be 5 : 6?

265. An alloy is composed of three metals, copper, tin and iron in the ratio 17 : 2 : 3. If the alloy contains 19 units of tin, how many units of the other metals are required to make the alloy?

266. The weight of dry ingredients in a recipe is 675 grams and the ratio of flour to sugar is 8 : 7. How much sugar would have to be added for the ratio to be 9 : 10?



Merit/Excellence – Answer the following questions.

267. A company's ratio of sales of three different types of calculators are 6 : 3 : 2 (scientific, graphic and algebraic). If the company sells 15 graphic calculators in one month how many scientific and algebraic calculators did they sell?
268. A company has a ratio of male to female employees of 15 : 11. Currently the company has 208 employees, but is offering voluntary redundancy to any male staff so that the ratio reduces to 12 : 11. How many male staff can accept voluntary redundancy?
269. The cost ratio in building a new house is 21 : 5 : 4 (construction : decor : landscaping). If the Smith's spend \$112 500 on landscaping, and decor what is their construction costs and the total cost of the new house?
270. If the ratio $4 : x = x : 9$, find the value of x .
271. If the ratio $25 : 4x = x : 4$, find the value of x .
272. The cost ratio in printing a number of books is 4 : 2 : 1 (printing : paper : cover). If a publisher spends \$45 000 on printing plus covers, how much would the paper component be and what is the total printing cost?
273. If the ratio $9 : 2x - 4 = 5 : x$, find the value of x .
274. A company has a sales ratio of Workbooks to Homework Books of 11 : 8. Last year it sold 53 200 books in total. By how much would its Homework Book sales have to drop so its sale ratio became 77 : 50?

Proportion



Proportion

A proportion is a part considered in relation to a whole or a statement of equality between two or more ratios.

$$\text{i.e. } \frac{a}{b} = \frac{c}{d}$$

Directly Proportional Problems

Directly proportional problems are problems where a change in one quantity causes a proportional change in another quantity.

Two quantities y and x are in direct proportion if by whatever y changes, x changes by the same proportion or multiplier.

We write $y \propto x$, which is read as y is directly proportional to x , this means $y = kx$, where k is a constant.

E.g. The cost of pens is directly proportional to the number of pens you buy. If two pens cost \$1.50, how many pens can you buy for \$10.50?

First we find k , $1.50 = 2k$

$$k = 0.75 \text{ (each pen costs 75 cents)}$$

To calculate how many pens we can buy for \$10.50 we divide 10.50 by the cost of a single pen 0.75 which equals 14 pens.

Inversely Proportional Problems

Inversely proportional problems are problems that are similar to directly proportional problems except that when x increases y will decrease and vice versa.

Two quantities y and x are inversely proportional if their product always remain constant, i.e. $xy = k$ or

$$y = \frac{k}{x} \text{ where } k \text{ is a constant.}$$

E.g. If it takes 4 men 6 hours to dig a drain, how long will it take 7 men to do the same job?

First we find k , which is $4 \times 6 = 24$ (total number of man hours).

To find how long it will take 7 men to dig the drain we divide 24 (total number of man hours)

$$\text{by } 7 = 3\frac{3}{7} \text{ hours.}$$



A good test of an inverse proportional problem is to ask yourself,

"If one quantity doubles, will the other half", i.e. if x increases by a multiplier, y will decrease by the same divisor.



Directly proportional problems can also be set up as ratios, but make sure that the two ratios are written in the correct order.

In the problem on the left,

$$\text{if } x = \text{the number of pens then } \frac{1.5}{2} = \frac{10.5}{x}$$

$$\text{Solving this equation gives } 1.5x = 21 \\ \text{and then } x = 14$$



Two quantities x and y are said to be inversely proportional if their product xy always remains constant.

In the problem on the left,

if x = the number of hours then

$$4 \text{ men} \times 6 \text{ hours} = 7 \text{ men} \times x$$

$$24 = 7x$$

$$x = 3\frac{3}{7} \text{ hours}$$



The ratio of the number of men = the inverse ratio of the number of hours.

$$\text{i.e. } 4 : 7 = x : 6$$

$$\frac{4}{7} = \frac{x}{6}$$

$$7x = 24$$

$$x = 3\frac{3}{7} \text{ hours}$$



The more men the less time to complete the job, hence this is an inversely proportional problem.

When x increases, y decreases.

**Example**

If Paul ran 200 metres in 34 seconds, how long would it take him to run three metres?



This is a directly proportional problem as double the distance will double the time. The further Paul runs the longer it will take or conversely the shorter the distance Paul runs the less time it will take.

Setting up as ratios, if x = the number of seconds

$$\frac{200}{34} = \frac{3}{x}$$

$$200x = 102$$

$$x = 0.51 \text{ seconds}$$

**Example**

If it takes 5 men six hours to repair a transformer how long will it take 7 men to do the same job if they work at the same rate?



This is an inversely proportional problem. The more men on the job the less time it should take to complete the task.

So $5 \text{ men} \times 6 \text{ hours} = 7 \text{ men} \times T$

$$30 = 7T$$

$$T = 4.3 \text{ hours (1 dp)}$$



Achievement/Merit – Answer the following directly proportional and inversely proportional questions.

275. To make 5 apple pies requires 3 kg of apples. How many kg of apples would be needed to make 8 apple pies? (*Directly proportional*)

276. If a 108 kg man on earth weighs 18 kg on the moon what would a 7 kg boy on the moon weigh on earth? (*Directly proportional*)

277. A farmer has enough feed for 50 head of stock for 8 days. If the farmer sells 10 head of stock, how long will the feed last for now? (*Inversely proportional*)

278. A family of four has budgeted enough money to last them for a month (30 days). If two visitors turn up for the month how long will their budgeted amount now last? (*Inversely proportional*)

279. A tramping group has enough food for four people for 12 days. If two more people decide to join the tramp, how long will the food now last? (*Inversely proportional*)

280. Last year Jason travelled 12 500 km in his car and used 1500 litres of fuel. This year he predicts he will travel a total of 15 000 km. How much more fuel will he use this year? (*Directly proportional*)



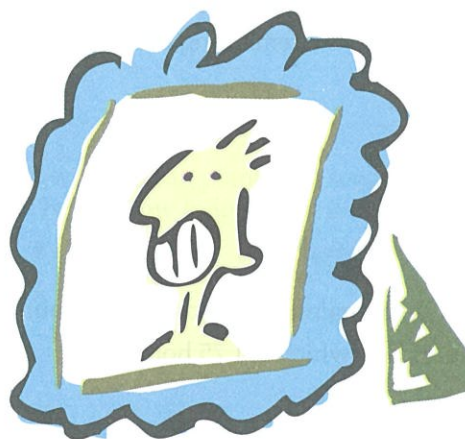
Achievement/Merit – Answer the following directly proportional and inversely proportional questions.

281. The current A in an electric circuit is inversely proportional to the resistance R in the circuit. When the resistance is 7.5 ohms, the current is 5 amperes. Find the resistance if the current is 9 amperes.
282. The speed Simon bikes at is inversely proportional to the time it takes him to get to school. It takes Simon 20 minutes to get to school at an average speed of 12 km/h. If he wants to reach school in 15 minutes what should his average speed be?
283. Lee is planning a trip to Thailand. The exchange rate is 22.5 Thai baht for \$1 NZD. How many baht would Lee get for \$1000 NZD?
284. Molly took a trip to Mexico. She exchanged \$125 NZD and got 1125 pesos. Later in the trip she wanted to exchange 4500 pesos to dollars. How much would she get in NZD?
285. Tony had a photo measuring 48 cm in width and 125 cm in height. He decides to reduce its size in proportion. If the reduced width is 40 cm what will be the new height?
286. Ming gets charged an additional \$37.35 for her baggage being overweight by 4.5 kg. How much does her friend Lin pay if she is overweight by 6.2 kg?
287. Water usage is directly proportional to the number of people living in a house. A family of four have an average water usage of 1800 litres per day. If two additional people visit, how much would their daily water usage be now?
288. The number of bales of hay a farmer uses in a season is directly proportional to his herd size. If he requires 1000 bales of hay for a herd of 160, how many bales in total will he need if the size of his herd increases by 40 head?
289. The ingredients needed to make 24 scones are:
- | | |
|----------------|----------------------|
| 600 g of flour | 250 g of butter |
| 250 ml of milk | 100 g of dried fruit |
- How much dried fruit is needed for a batch of 8 scones?
 - How much flour would be required for a batch of 40 scones?
 - How much milk is required for a batch of 36 scones?
 - How much butter is required for a batch of 18 scones?



Merit/Excellence – Answer the following questions involving proportions by first identifying whether they are directly or inversely proportional.

290. Tom is working on an essay. He can type at the rate of 35 words per minute and in 2.6 hours can key in the essay. If Jane can type at 23 words per minute how long would it take them working together (at 58 words per minute) to enter the essay?
291. A building crew of 15 tradesmen can construct a house in 90 days. If the owner of the house wanted to have the house built in 50 days, how many extra tradesmen would he have to hire?
292. A company has enough money in its bank account to pay the wages of 25 workers for 40 days. If the company took on another five workers, how long could it afford to pay the entire work force?
293. If three-sevenths of a tank can be filled in five minutes, how long would it take to fill the entire tank?
294. A building has a shadow that is 45 metres long, while a vertical flag pole that is 6 metres long makes a shadow of 8 metres. How high is the building?
295. Water is leaking out of a tap at a constant rate. If after 3 minutes 10 litres has leaked, how long will it take for 25 litres to leak out?
296. The tax on a property valued at \$650 000 is \$29 250. What would be the value of a property with a tax assessment of \$35 000?
297. A picture that currently measures 35 cm high by 50 cm wide is to be enlarged so that the width is 90 cm. What will be the new height of the frame?





Merit/Excellence – Answer the following questions.

- 306.** Fifteen labourers can lay 85 metres of cable in 10 days. How long would it take
- 12 labourers to lay 85 metres of cable?
 - 8 labourers to lay 100 metres of cable?
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- 307.** If it takes four people three days to assemble ten TVs, how long would it take
- 6 people to assemble 10 TVs?
 - 5 people to assemble an order of 15 TVs?
 - The company has an order for 50 TVs in 4 days time, how many people do they need to employ to assemble them?
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- 308.** A magazine comprising 120 pages can be produced by a staff of 15 in 30 days. How long would it take for
- 9 people to produce the same magazine?
 - 12 people to produce a 208 page magazine?
 - The publisher has decided to produce the 120 page magazine every two weeks (10 working days), how many employees do they need?
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- 309.** A gang of 60 workers can lay 900 metres of railway track in 20 days.
- What is their rate of track laid/worker/day?
 - How long would it take a gang of 50 workers to lay one kilometre of track?
 - The railway company wish to complete a section of track, 1.8 km in length in 24 days, how many workers do they require?
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- 310.** An object travels at a speed of 15 m/s.
- How long will it take the object to travel a distance of 3 km?
 - What is the speed of the object in km/h?
 - If the object travels at a speed of 15 m/s for 30 minutes and at a speed of 20 m/s for the next 30 minutes, what is its average speed in km/h?
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- 311.** One decorator can decorate a room in twelve hours and another decorator can decorate it in eight hours. How long would it take the two decorators working together to decorate the room?
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-
- 312.** Two electricians are wiring a house. The first electrician could complete the job in 6 hours on his own, while the apprentice would take 8 hours. They work together for the first two hours, but then the first electrician works on his own to complete the job, while the apprentice goes off on another job. How long will it take to wire the house?
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-
-
-
-
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Page 19 cont...

190. \$37.50
 191. \$17
 192. 75.7% (1 dp)
 193. 600 boys
 194. a) \$914.16
 b) \$68.56
 c) \$86.85
 d) \$83

Page 21

195. \$258.30
 196. 126.1
 197. \$41.56
 198. \$47.25
 199. \$110.98
 200. \$3499.13
 201. 506 pupils
 202. \$649 900
 203. 1544 or 1545
 204. \$19 125

Page 22

205. 31.4 % (1 dp)
 206. 23.1 % (1 dp)
 207. 10.7% (1 dp)
 208. 20.8% (1 dp)
 209. 38.0 % (1 dp)
 210. 46.6% (1 dp)
 211. \$182.61
 212. \$430.43
 213. \$45
 214. \$2086.96
 215. \$168.18
 216. \$133.90
 217. \$476.86
 218. 12.0% (1 dp)

Page 23

219. a) \$314.50
 b) \$254.75
 c) 11.3% (1 dp)
 d) Receives \$266.00 now so better off by \$11.25
 e) 77.6% (1 dp)

Page 23 cont...

220. a)

Commission – Company A	\$210 000
Flat fee of \$400	\$400
4.5% of \$100 000	\$4500
2.5% of \$110 000	\$2750
Total (excluding GST)	\$7650
Total (including GST of 15%)	\$8797.50

b)

Commission – Company B	\$210 000
Flat fee	\$250
4% of \$80 000	\$3200
3.5% of \$130 000	\$4550
Total (excluding GST)	\$8000
Total (including GST of 15%)	\$9200

- c) \$402.50
 d) 4.4% (1 dp)

Page 24

221. \$7024.64
 222. \$23 534.07
 223. 14.4% more (1 dp)
 224. a) \$30.52
 b) \$15.52
 c) 103.5%

225. a) Option 1 = \$7693.12
 Option 2 = \$8525
 Option 2 better by \$831.88
 b) 10.8%
 c) 11.3%

Page 26

226. 1 : 2
 227. 1 : 16
 228. 1 : 3
 229. 2 : 3
 230. 16 : 1
 231. 2 : 5
 232. 3 : 4 : 10
 233. 4 : 9 : 3
 234. 3 : 5
 235. 1 : 50
 236. 1 : 6
 237. 2 : 3 : 5
 238. 10 : 6 : 2 : 1
 239. 1 : 30
 240. 1 : 100 000

Page 26 cont...

241. 3 : 10
 242. $w = 35$
 243. $x = 144$
 244. $y = 2.33$ (2 dp)
 245. $z = 12$
 246. \$12, \$20
 247. 30 L, 10 L
 248. \$49.78, \$78.22
 249. 4.75 L, 0.25 L
 250. 1.2 m, 2.4 m, 1.6 m
 251. \$8.95, \$5.37, \$14.32, \$7.16
 252. \$6.60, \$11.00
 253. \$66, \$55, \$22
 254. Alysia = \$144
 Barbara = \$96
 255. Clare = \$26.67
 Dennis = \$20
 Elliot = \$33.33
 256. \$3400 and \$5100
 257. \$480 and \$200

Page 27

258. \$15
 259. 1.56 litres
 260. 12 cows
 261. 56 kg
 262. a) 1333 g (1.333 kg)
 b) 67 500 L
 c) \$247.50
 d) \$224.24
 e) 162.5 ml
 f) 7.5 km
 g) 3 gold medals.

Page 28

263. $24 + 48 + 60 = 132$
 264. 10 men
 265. 161.5 units of copper and 28.5 units of iron
 266. 85 grams

Page 29

267. 30 scientific and 10 algebraic calculators.
 268. 24 males
 269. Construction cost = \$262 500
 Total cost = \$375 000

Page 29 cont...

270. $x = 6$
 271. $x = 5$
 272. Printing = \$36 000
 Paper = \$18 000
 Covers = \$9000
 Total cost = \$63 000
 273. $x = 20$
 274. By 2400 books.

Page 31

275. 4.8 kg
 276. 42 kg
 277. 10 days
 278. 20 days
 279. 8 days
 280. Uses an additional 300 L
 (1800 L in total).

Page 32

281. 4.2 ohms
 282. 16 km/h
 283. 22 500 baht
 284. \$500
 285. 104.2 cm (1 dp)
 286. \$51.46
 287. 2700 L
 288. 1250
 289. a) 33.3 g (1 dp)
 b) 1 kg
 c) 375 ml
 d) 187.5 g

Page 33

290. 1.6 hours
 291. An extra 12 tradesmen
 (27 in total)
 292. For 33 days (33.3)
 293. 11.7 minutes
 294. 33.75 m
 295. 7.5 minutes
 296. \$778 000 (3 sf)
 297. 63 cm

Page 35

298. a) 7.5 seams/minute
 b) 337 or 338 seams (337.5)
 c) 133.3 minutes (1 dp)
 299. a) \$14.75 per hour
 b) \$3156.50
 c) 340 hours
 300. a) 427.5 km
 b) 26.39 m/s
 c) 3.8 seconds (1 dp)
 301. a) 18.7 minutes
 b) 38.9 hours
 c) 900 L/h
 302. a) 25 kg/h
 b) 23.3 kg/h
 303. a) 0.354 cm/h
 b) 23 days 13 hours
 304. a) 12 days
 b) 1.2 days
 c) $\frac{12}{x}$ days
 305. a) 7.5 hours
 b) 4 hours
 c) $\frac{60}{x}$ hours

Page 36

306. a) 12.5 days
 b) 22.1 days
 307. a) 2 days
 b) 3.6 days
 c) 15 people
 308. a) 50 days
 b) 65 days
 c) 45 people
 309. a) 0.75 m track/worker/day
 b) 26.7 days
 c) 100 workers
 310. a) 200 seconds
 b) 54 km/h
 c) 63 km/h
 311. 4.8 hours
 312. 4.5 hours

Page 38

313. 25
 314. 21

Page 38 cont...

315. 4
 316. 64
 317. 17
 318. 60
 319. 168
 320. 168
 321. 98
 322. 540
 323. 288
 324. 24
 325. 35
 326. 177
 327. $1\frac{1}{24}$
 328. $\frac{1}{2}$
 329. $\frac{17}{25}$
 330. $\frac{27}{70}$
 331. 2
 332. $\frac{73}{120}$
 333. 44
 334. -27
 335. $\frac{2}{5}$ (0.4)
 336. $2\frac{5}{14}$ (2.357 (3 dp))
 337. $\frac{3}{20}$ (0.15)
 338. $\frac{7}{9}$ (0.778 (3 dp))
 339. $\frac{2}{3}$ (0.667 (3dp))
 340. $\frac{-1}{32}$ (-0.03125)
 341. $71 - 6 \times 8 + 7 \times (4 - 4) - 3$
 $71 - 48 + 7 \times \textcircled{0} - 3$
 $71 - 48 + 0 - 3$
 $= 20$
 342. $9 + 3 - 16 + 5 \times 4 - 2$
 $9 + 3 - 16 + 20 - \textcircled{2}$
 $12 - 16 + 20 - 2$
 $-4 + 20 - 2$
 $16 - 2$
 $= 14$

Page 40

343. $\frac{1}{8}$
 344. $\frac{1}{25}$