Changing the Subject: Advanced

Video 8 on www.corbettmaths.com

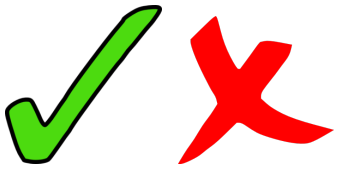
Question 3: Make c the subject of the following

(a) $w = \frac{ac}{a - c}$ (b) $w = 6 + \frac{a}{c + 2}$

Apply

Question 1: The cosine rule is $a^2 = b^2 + c^2 - 2bc \cos A$.
Make cos A the subject.

Answers



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1 Simplify fully $\frac{x^2+5x}{x^2+7x+10}$

(2 marks)

2 Simplify fully $\frac{x^2-x-12}{x^2-9x+2}$

(2 marks)

3 Simplify fully $\frac{3x^2+9x}{x^2-9}$

(2 marks)

0

4 Simplify fully $\frac{x+4}{x^2-16}$

(2 marks)

5 Write $\frac{3x^2+11x-4}{x^2+3x-4}$ in the form $\frac{ax+b}{x+c}$ where *a, b,* and *c* are integers.

(3 marks)

6 Write $\frac{x^2+7x-18}{2x^2-x-6}$ in the form $\frac{x+a}{bx+c}$ where *a, b,* and *c* are integers.

(3 marks)

7 Simplify fully $\frac{3x+6}{x-4} \div \frac{2x^2+9x+10}{x^2-4x}$

(3 marks)

8 Simplify fully $\frac{2x-2}{x+5} \div \frac{x^2-4x+3}{2x^2+13x+15}$

(3 marks)

9 Solve $\frac{8}{x+3} + \frac{3}{x+8} = 1$

(4 marks)

10 Solve $\frac{8}{3x-2} + \frac{6}{x+1} = 2$

(4 marks)

11 Solve $\frac{2}{5-x} + \frac{3}{x+7} = 1$

(4 marks)

12 Solve $\frac{7}{x+1} + \frac{4}{3x-2} = 1$

(4 marks)

13 Given that

$$3x + 5 : x + 4 = 2x + 4 : x + 2$$

Find the possible values of x.

(4 marks)

14 Given that

$$x - 1 : 2x - 3 = x + 2 : 3x - 2$$

Find the possible values of x.

(4 marks)

15 Given that

$$x + 9 : 5x - 1 = x + 7 : 2x - 3$$

Find the possible values of x.

(4 marks)

16 Given that

$$5 - 3x : 9 - x = 3x + 7 : 4 - x$$

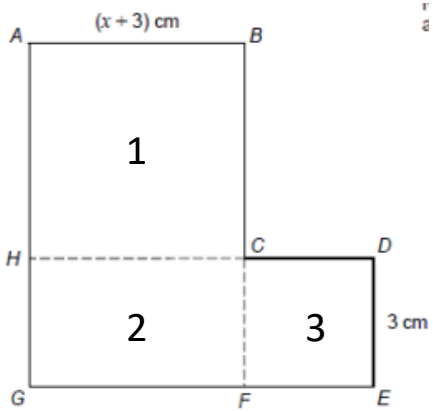
Find the possible values of x.

(4 marks)

Forming and Solving Equations

Hard example

ABCH is a square. HCFG is a rectangle. CDEF is a square.



Show that the total area of the L-shape in cm² is $x^2 + 9x + 27$

Remember when you multiply two expressions like this together it forms double brackets

Area of square 1: $(x + 3) \times (x + 3)$
$= (x + 3)(x + 3)$
$= x^2 + 6x + 9$

Area of rectangle 2: $3 \times (x + 3)$
$= 3x + 9$

Area of square 3: $3 \times 3 = 9$

Total area $= x^2 + 6x + 9 + 3x + 9 + 9$
$= x^2 + 9x + 27$

x+2

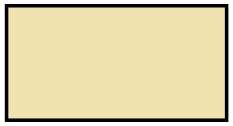
The area of this shape is 36cm².
Find the value of x.

(x+7)

(x - 2)

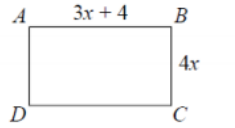
The area of this shape is 22cm².
Find the value of x.

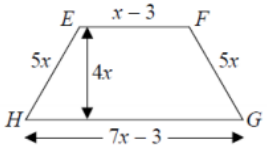
(2x - 9)



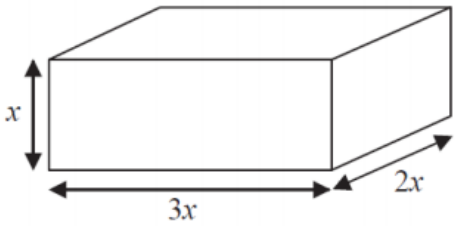
(x - 2)

The area of this shape is 42cm².
Form an equation for the area of this shape
Solve this equation and obtain a suitable value for x

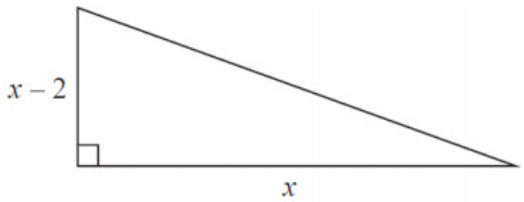




ABCD is a rectangle. EFGH is a trapezium.
All measurements are in centimetres.
The perimeters of these two shapes are the same.
Work out the area of the rectange.



All measurements are in centimetres.
X is an integer.
The total volume of the cuboid is less that 900cm³
Show that x ≤ 5



The area of the triangle is 2.5 cm².
Find the perimeter of the triangle. Give your answer correct to 3 significant figures.

Mixed exam questions

Q1. June 2015 unit 1

Here is a shape.

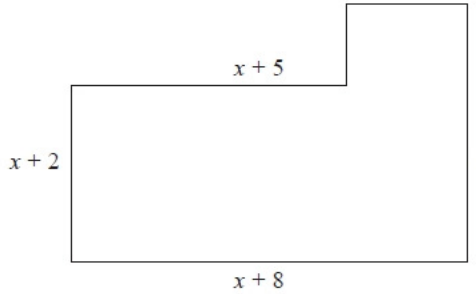


Diagram **NOT** accurately drawn

All the measurements are in centimetres. All the corners are right angles.
The area of the shape is *A* cm².
Find a formula for *A* in terms of *x*.
Give your answer in its simplest form.

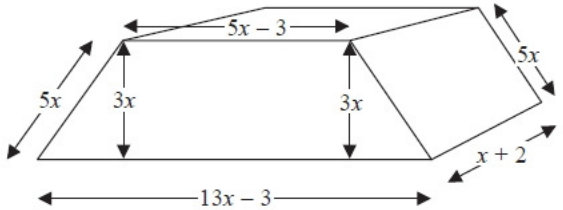
A = ...

(Total for question = 4 marks)

Q2. June 2014 unit 1

***** This shape is a solid prism. The cross section of the prism is a trapezium.

Diagram **NOT** accurately drawn



Show that the total surface area of the prism is $82x^2 + 32x - 12$

(Total for Question is 4 marks)

Q3. **November 2014 paper 1**

The diagram shows the plan of a floor.

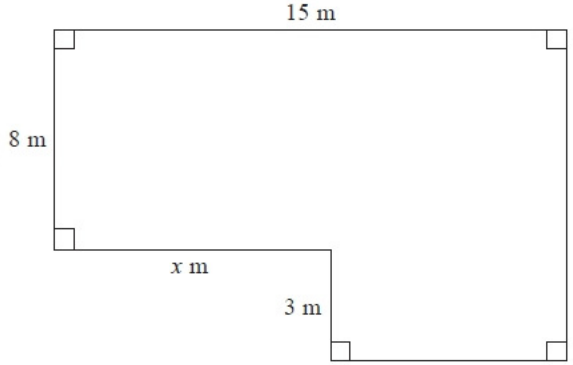


Diagram **NOT** accurately drawn

The area of the floor is 138 m^2.
Work out the value of *x*.

.....

(Total for Question is 4 marks)

Examiner's Report Key notes

- Be careful when subtracting expressions. E.g. (x + 8) − (x + 5) is actually x + 8 – x – 5.
- Remember to set out your working out carefully. Make it clear to the examiner what you are trying to calculate. On this type of question it may halp to number each section of the shape.

Answers

$(x + 2)(x + 2) = 36$ $x^2 + 4x + 4 = 36$ $x^2 + 4x - 32 = 0$ $(x + 8)(x – 4) = 0$ $X = -8$ or 4 so $x = 4$	$(x + 7)(x - 2) = 22$ $x^2 + 5x - 14 = 22$ $x^2 + 5x - 36 = 0$ $(x + 9)(x – 4) = 0$ $X = -9$ or 4 so $x = 4$
$(2x – 9)(x – 2) = 42$ $2x^2 - 13x + 18 = 42$ $2x^2 - 13x - 24 = 0$ $(2x + 3)(x – 8) = 0$ so $x = 8$	
Perimeter of the rectangle: $3x + 4 + 3x + 4 + 4x + 4x = 14x + 8$ Perimeter of the trapezium: $7x – 3 + 5x + 5x + x – 3 = 18x – 6$ The perimeters are equal, so $14x + 8 = 18x – 6$ $8 = 4x – 6$ $14 = 4x$ so $x = 3.5$ Area of the rectangle = $(3x + 4) \times 4x$ $= (10.5 + 4) \times 14 = 14.5 \times 14 = 187cm^2$	
Volume = $x \times 3x \times 2x = 6x^3$ $6x^3 < 900$ $x^3 < 150$ the nearest cube number is 120, which is 5 cubed so $x \leq 5$	
$x^2 - 2x = 2.5$ $x^2 - 2x - 2.5 = 0$ Using the quadratic formula, $x = 2.87$ To find the perimeter, we need to use Pythagoras first. $X – 2 = 2.87 – 2 = 0.87$ $c^2 = 0.87^2 + 2.87^2$ $c^2 = 8.9938$ $c = 3.00$ Perimeter = $0.87 + 2.87 + 3 = 6.74cm$	

Exam questions

Q1.

Answer	Mark	Notes
$x^2+10x+22$	4	M1 for $(x+8) – (x+5)$ (=3) or $(x+4) – (x+2)$ (=2) M1 for area of one rectangle eg $(x+2)(x+5)$ $(= x^2+7x+10)$ M1 for complete method to find area e.g. $(x+2)(x+5) + 3(x+4)$ $(= x^2+7x+10 + 3x+12)$ A1 cao

Q2.

Working	Answer	Mark	Notes
Front or Back: $\frac{1}{2} \times 3x(13x – 3 + 5x – 3)$ $= 27x^2 – 9x$ or $\frac{1}{2}(4x)(3x) + 3x(5x – 3)$ **Top**: $(5x – 3)(x + 2)$ $= 5x^2 + 7x – 6$ **Bottom**: $(13x–3)(x + 2)$ $= 13x^2 + 23x – 6$ **Each Side**: $5x(x + 2)$ $= 5x^2 + 10x$ **Total SA** = $2(27x^2 – 9x) +$ $2(5x^2 + 10x) + (5x^2 + 7x – 6)$ $+ (13x^2 + 23x – 6)$ $= (54 + 10 + 5 + 13)\,x^2$ $+ (–18 + 20 + 7 + 23)\,x$ $+ (– 6 – 6)$	$82x^2 + 32x – 12$	4	M1 finds the area of at least 2 faces (condone omission of brackets) M1 writes a correct algebraic expression for the area of at least 3 different faces M1 correct expressions for all 6 faces and adds C1 (dep on M3) for correct algebraic expression as a correct summary

Q3.

Answer	Mark	Notes
9	4	M1 for method to find area of one rectangle, eg 15×8 (=120) or 15×11 (=165) M1 (dep) for subtracting from/by given area, eg (138 – "120") (=18) or "165" – 138 (=27) M1 for final step from complete method shown, eg 15 – "18" ÷ 3 or "27" ÷ 3 A1 cao **OR** M1 for a correct expression for the area of one rectangle, eg $(8 + 3) \times (15 – x)$ or $8 \times x$ M1 (dep) for a correct equation eg $(8 + 3) \times (15 – x) + 8 \times x = 138$ M1 for correct method to isolate x, eg $3x = 27$ A1 cao

1) Equations and Indices: Easier

1) Simplify

a) $(a^5)^3$

_____

b) $(2a)^4$

_____

c) $(-2a^2)^4$

_____

d) $(3a^2b^3)^3$

_____

e) $\sqrt[3]{64t^{27}v^{15}}$

_____

(5 Marks)

2) Express (where possible) each of the following as 2^k for some value of k

a) 8

_____

b) 1

_____

c) $\frac{1}{2}$

_____

d) $\sqrt{2}$

_____

e) $\sqrt{8}$

_____

f) $\frac{1}{\sqrt{2}}$

_____

g) $\left(\sqrt{8}\right)^3$

_____

(7 Marks)

1) Equations and Indices: Medium

3) Solve the equation

$$3^{x+1} = \frac{27^x}{9}$$

(5 Marks)

4) Solve the equation

$$25^{x-1} = 5\sqrt{5}$$

(5 Marks)

5) Solve the equation

$$\frac{16^x}{2^{x-1}} = 2^{\frac{1}{2}}$$

(5 Marks)

1) Equations and Indices: Harder

6) Solve the equation

$$\frac{8^{x+1}}{2^x} = 16$$

(5 Marks)

7) Solve the equation

$$27^y = 3^{1+y}$$

(5 Marks)

8) Solve the equation

$$\left(\frac{1}{4}\right)^n = 8^{n+1}$$

(5 Marks)

Sketching Quadratics
Video 265 on Corbettmaths

Question 5: Sketch the following graphs.

(a) $y = x^2 + 6x + 8$ (b) $y = x^2 - x - 6$ (c) $y = x^2 + 6x + 9$

(d) $y = x^2 - 13x + 42$ (e) $y = x^2 + 5x - 36$ (f) $y = x^2 - 2x + 1$

(g) $y = x^2 + 5x + 11$ (h) $y = x^2 - 4x + 7$

Question 6: Sketch the following graphs.

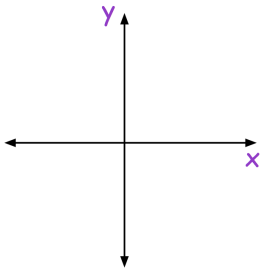
(a) $y = (x - 7)(x + 10)$ (b) $y = (x + 3)(x + 8)$ (c) $y = (x - 2)^2$

Question 7: Sketch the following graphs.

(a) $y = x^2 - 49$ (b) $y = x^2 - 1$ (c) $y = x^2 - 196$

Question 8: Michael wants to sketch the graph of $y = -x^2 + 5x + 14$

(a) Find the value of y when $x = 0$
(b) Use your answer to (a) to plot where the graph crosses the y–axis.
(c) Solve the equation $-x^2 + 5x + 14 = 0$
(d) Use your answers to (c) to help you plot where the graph crosses the x–axis.
(e) Sketch the graph of $y = -x^2 + 5x + 14$



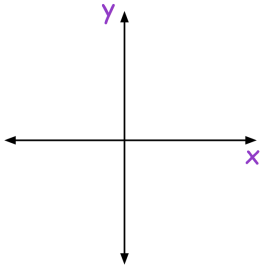
Question 9: Sketch the following graphs.

(a) $y = -x^2 - 5x - 4$ (b) $y = -x^2 + 9x - 18$ (c) $y = 84 - 5x - x^2$

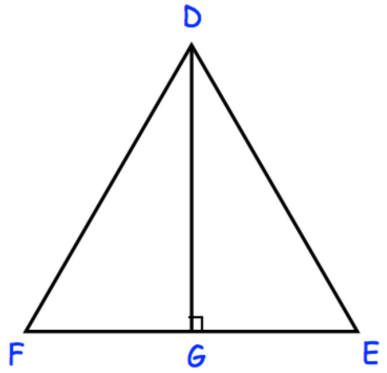
(d) $y = (3 - x)(x + 8)$ (e) $y = -x^2 - 8x - 16$ (f) $y = 144 - x^2$

Question 10: Robyn wants to sketch the graph of $y = 2x^2 + 9x + 4$

(a) Find the value of y when $x = 0$
(b) Use your answer to (a) to plot where the graph crosses the y–axis.
(c) Solve the equation $2x^2 + 9x + 4 = 0$
(d) Use your answers to (c) to help you plot where the graph crosses the x–axis.
(e) Sketch the graph of $y = 2x^2 + 9x + 4$



9. DEF is an equilateral triangle.

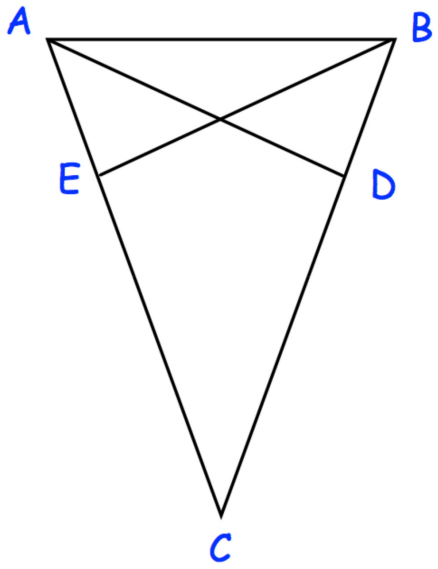


G lies on EF.
DG is perpendicular to FE.

Prove DFG is congruent to DEG.

(3)

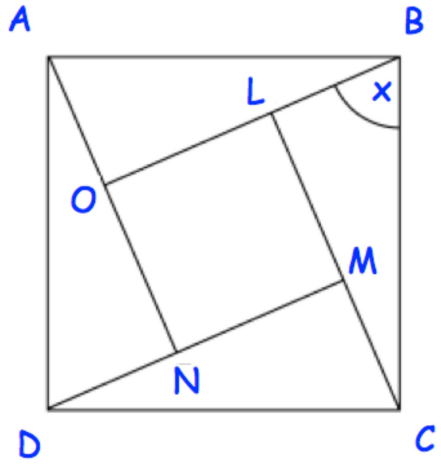
10. ABC is an isosceles triangle in which AC = BC.
D and E are points on BC and AC such that CE = CD.



Prove triangles ACD and BCE are congruent.

(4)

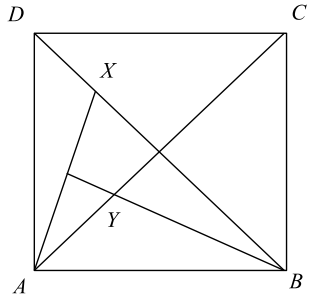
11. ABCD and LMNO are squares.
Angle CBL = x



Prove that triangles ABO and CBL are congruent.

(4)

12. ABCD is a square, X is a point in the diagonal BD and the perpendicular from B to AX meets AC in Y.



Prove that triangles AXD and AYB are congruent.

(4)

Error Intervals

Video 377 on www.corbettmaths.com

Examples

Click here

Scan here

Workout

Question 1: The mass of a coin is 8 grams to the nearest gram.
Complete the error interval for the mass of the coin

..... g ≤ mass < ..... g

Question 2: The distance between two cities is 900km to the nearest 100km.
Complete the error interval for the distance

..... km ≤ distance < ..... km

Question 3: Frank rounds a number, y, to the nearest ten.
His result is 20
Write down the error interval for y

Question 4: Lily rounds a number, y, to the nearest whole number.
Her result is 5
Write down the error interval for y

Question 5: Freya rounds a number, y, to one decimal place.
Her result is 6.4
Write down the error interval for y

Question 6: Oscar rounds a number, y, to the nearest integer.
His result is 100
Write down the error interval for y

Question 7: A number, n, is rounded to 1 decimal place.
The result is 1.3
Using inequalities, write down the error interval for n.

Question 8: A number, n, is rounded to 2 decimal places.
The result is 6.27
Using inequalities, write down the error interval for n.

Question 9: Elliott weighs 56.2kg.
This mass, m, is to the nearest 100g.
Write the error interval due to rounding.

Error Intervals

Video 377 on www.corbettmaths.com

Question 10: A number, x, is 21 when rounded to 2 significant figures.
Write down the error interval.

Question 11: A number, y, is 15000 when rounded to 2 significant figures.
Write down the error interval.

Question 12: A number, y, is 680000 when rounded to 3 significant figures.
Write down the error interval.

Question 13: The length of a line, l, was given as 2.8cm, truncated to 1 decimal place.
Complete the error interval for l

..... $cm \leq l <$ ..... cm

Question 14: A number, y, is 0.37 when truncated to 2 decimal places.
Complete the error interval for y

..... $\leq y <$ .....

Question 15: A number, n, is truncated to 1 decimal place.
The result is 18.1
Using inequalities, write down the error interval for n.

Question 16: A number, n, is truncated to 3 decimal places.
The result is 4.066
Using inequalities, write down the error interval for n.

Apply

Question 1: The length of each side of a regular hexagon is 4.7cm to 1 decimal place.
Write the error interval for the perimeter, P

Question 2: Grace and George complete a crossword.
It takes Grace 9 minutes to complete the crossword to the nearest minute.
It takes George 11 minutes to complete the crossword to the nearest minute.

Show that the total time for both people to complete the crossword could be 20 minutes 50 seconds.

Question 3: A man jogs 200 metres to the nearest 10 metres.
It takes him 30 seconds to the nearest 10 seconds.

Work out the error interval for his speed, s.

Error Intervals

Video 377 on www.corbettmaths.com

Question 4: A number, x, is 1.92 when truncated to 2 decimal places.
Matthew has been asked to write down the error interval.
This is his answer.

$$1.915 \leq x < 1.925$$

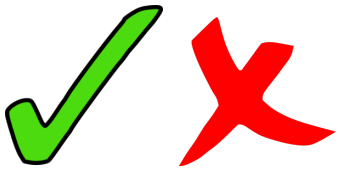
Explain why Matthew is wrong.

Question 5: A number, n, is rounded to 3 significant figures.
The result is 7500
Norris has been asked to write down the error interval for n.
This is his answer.

$$7450 < x < 7550$$

Explain why Norris is wrong.

Answers



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Stratified Sampling

Video 281 on www.corbettmaths.com

Question 10: The table below shows the age group of the members of a tennis club.

Age Group	Junior	Adult	Senior
Number	320	500	130

A stratified sample of 40 is to be taken.
Calculate the number for each age group in the sample.

Question 11: The table shows information about the ages of people on a train.

Age range	Frequency
under 18	16
18 to 40	41
41 to 60	84
over 60	29

The train conductor gives a questionnaire to some of these passengers.

She takes a sample of exactly 50 passengers stratified by age range.

Work out the number of passengers in each age range that the train conductor should have in her sample.

Question 12: The table below shows information about the vehicles sold by a dealership.

Car	Van	Motorbike	Caravan
5112	1048	2948	750

The manager takes a sample of 150 customers, stratified by type of vehicle sold.
Calculate the number of each vehicle type in the sample.

Apply

Question 1: Mr Henderson is going to survey the students in his school.
The table shows the number of students in each year group.

Year	Boys	Girls	Total
8	91	100	191
9	82	95	177
10	84	84	168
11	75	70	145
12	68	71	139
			820

Mr Henderson wants to take a sample of 60 students, stratified by year and by gender.

(a) What is a stratified sample?

(b) Work out the number of year 9 girls that should be in the sample.

(c) Describe a method to randomly select the year 9 girls

Stratified Sampling

Video 281 on www.corbettmaths.com

Question 2: A cricket club has 300 members.
A stratified sample of members is taken, by age group.

Some information is given in the table.

	Junior	18 - 40	41 - 60	Senior
Number of members	40		115	
Number in sample	8			7

Complete the table.

Question 3: Matthew owns 2400 stamps from several different countries.
He takes a stratified sample, by country.

Some information is given in the table.

Country	France	Spain	Turkey	UK
Number of stamps		320		1120
Number in sample		20	7	

Complete the table.

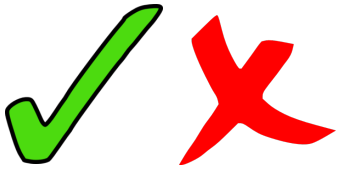
Question 4: Here is some information about the colour of raffle tickets sold.

Pink	Green	Yellow
145	125	340

A sample of size 20, stratified by colour of raffle ticket is taken.
From the sample of 20, two winning tickets are chosen at random.

Work out the probability that the two tickets are different colours.

Answers



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Box Plots

Videos 149 and 150 on www.corbettmaths.com

Question 4: Draw a box plot for each set of data

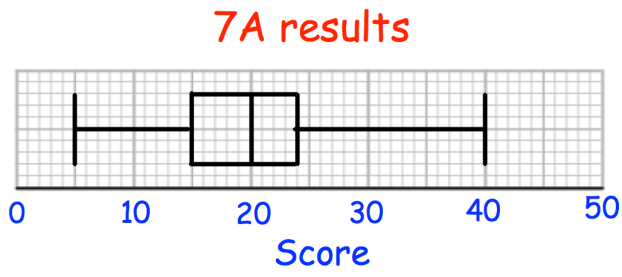
(a) 8, 10, 13, 14, 14, 15, 15, 16, 18, 19, 21, 22, 24, 29, 35

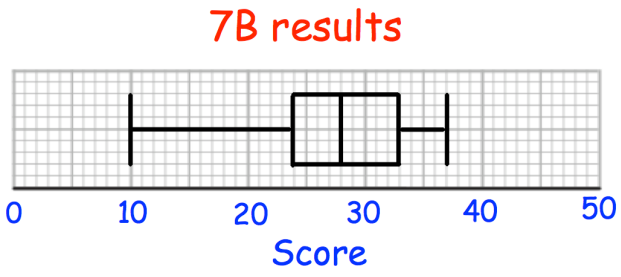
(b) 40, 80, 90, 90, 100, 120, 130

(c) 5.9, 7.3, 7.8, 8, 8.4, 8.7, 8.9, 8.9, 8.9, 9, 9, 9.1, 9.1, 9.3, 9.5, 9.6, 9.9, 10.5, 10.9

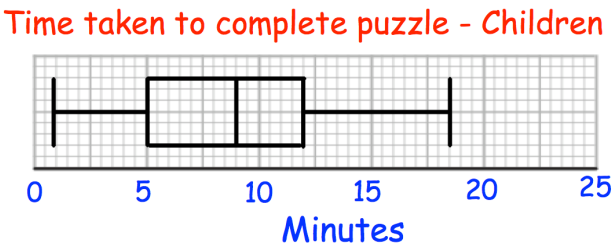
Question 5: Compare the distributions of each pair of box plots below.

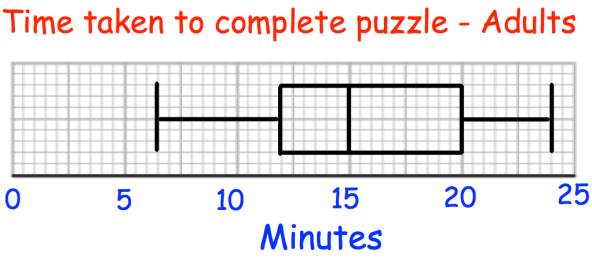
(a)



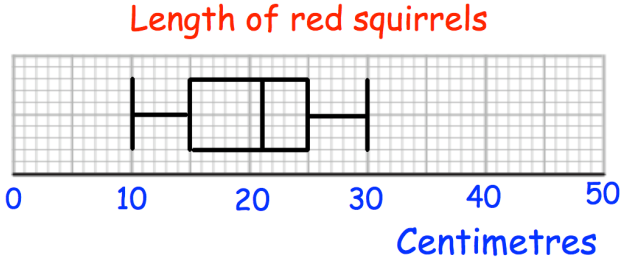


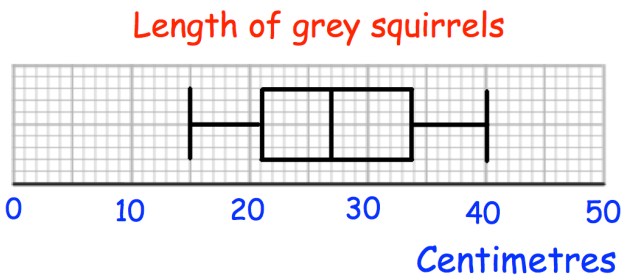
(b)



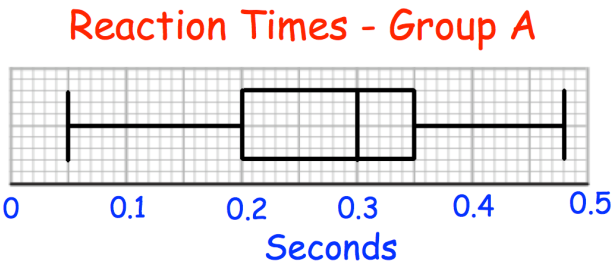


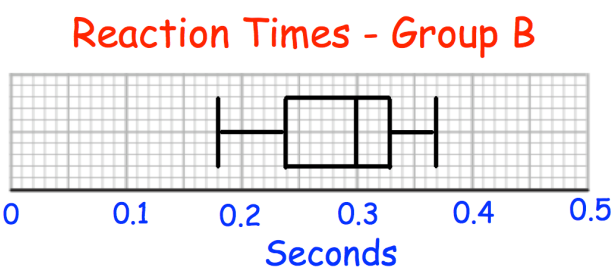
(c)





(d)





Box Plots

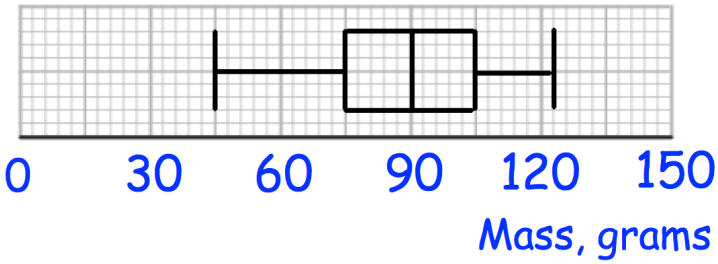
Videos 149 and 150 on www.corbettmaths.com

Question 3: Mr Jones is an estate agent on the Isle of Man.
He has created this table to show information about the prices of houses he has sold.

Explain how you know he has made a mistake.

Median	£375,000
Range	£235,000
Interquartile Range	£590,000

Question 4: The box plot show information about the masses of apples in a crate.



Jack is going to select apples at random from the crate.
After selecting each apple, he records its mass and returns it to the crate before picking another.
Work out the probability that:

(a) Jack picks two apples, both under 75g

(b) Jack picks two apples, both over 90g

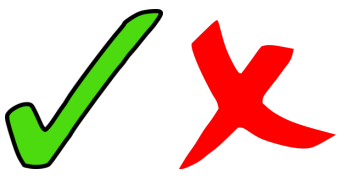
(c) Jack picks two apples, both over 105g

(d) Jack picks two apples, one under 90g and one over 105g

(e) Jack picks three apples, all over 105g

(f) Jack picks three apples, two over 105g and one under 75g.

Answers



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Product Rule for Counting

Video 383 on www.corbettmaths.com

Question 6: Oliver picks a 4-digit **even** number that is greater than 3000.
The second digit is a multiple of 4.

How many different numbers could Oliver pick?

Question 7: Sophia is creating a 6-digit code to lock her iPad.

She only uses digits greater than 2.
She only uses each digit once.

How many possible codes can Sophia create?

Question 8: In a class, there are 10 boys and 9 girls.
The teacher has been asked to pick one boy and one girl to win a prize.

How many possible pairs of students can the teacher pick?

Question 9: Jason picks a 5-digit number that is less that 80000.
The first digit is odd.
The fourth and fifth digits are equal.

How many different numbers can Jason pick?

Question 10: A headteacher wants to survey two Year 7 students.
There are 100 students in Year 7.

How many possible pairs of students can the headteacher pick?

Question 11: How many even numbers greater than 40000 can be created using these digits?

2	9	1	6	8

Apply

Question 1: On a school trip, students are given a packed lunch.
The students can choose one piece of fruit and one snack.
There are 8 different pieces of fruit and some different snacks.

Altogether there are 104 different ways to choose one piece of fruit and one snack

How many different snacks are there?

Product Rule for Counting

Video 383 on www.corbettmaths.com

Question 2: At a summer camp, children pick a morning, an afternoon and an evening activity.
There are 4 morning and 7 evening activities to pick from.

Altogether there are 224 different ways to choose their activities.

How many afternoon activities are there?

Question 3: In a gym there are

12 exercise classes on a Monday
13 exercise classes on a Wednesday
7 exercise classes on a Friday

Katie is going to attend either

a class on Monday and a class on Friday
or a class on Wednesday and a class on Friday
or a class on Monday, Wednesday and Friday

Work out how many different ways there are to pick which exercises classes Katie is going to attend.

Question 4: A group of 10 people enter a room.
Each person shakes hands, once, with all the other people in the room.

How many handshakes are there in total?

Question 5: A pizza parlour sells 9 different toppings.

Michael orders a pizza with 2 different toppings.

(a) How many different pizzas can he choose from?

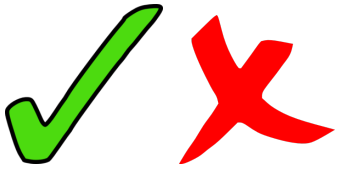
Beth orders a pizza with 3 different toppings.

(b) How many different pizzas can she choose from?

John orders a pizza with 4 different toppings.

(c) How many different pizzas can he choose from?

Answers



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C1 COORDINATE GEOMETRY *Worksheet A*

1 Find the gradient of the line segment joining each pair of points.

a (3, 1) and (5, 5) **b** (4, 7) and (10, 9) **c** (6, 1) and (2, 5) **d** (–2, 2) and (2, 8)

e (1, 3) and (7, –1) **f** (4, 5) and (–5, –7) **g** (–2, 0) and (0, –8) **h** (8, 6) and (–7, –2)

2 Write down the gradient and y-intercept of each line.

a $y = 4x - 1$ **b** $y = \frac{1}{3}x + 3$ **c** $y = 6 - x$ **d** $y = -2x - \frac{3}{5}$

3 Find the gradient and y-intercept of each line.

a $x + y + 3 = 0$ **b** $x - 2y - 6 = 0$ **c** $3x + 3y - 2 = 0$ **d** $4x - 5y + 1 = 0$

4 Write down, in the form $y - y_1 = m(x - x_1)$, the equation of the straight line with the given gradient which passes through the given point.

a gradient 2, point (4, 1) **b** gradient 5, point (2, –5)

c gradient –3, point (–1, 1) **d** gradient $\frac{1}{2}$, point (1, 6)

e gradient –2, point $(\frac{3}{4}, -\frac{1}{4})$ **f** gradient $-\frac{1}{5}$, point (–3, –7)

5 Find, in the form $y = mx + c$, the equation of the straight line with the given gradient which passes through the given point.

a gradient 3, point (1, 2) **b** gradient –1, point (5, 3)

c gradient 4, point (–2, –3) **d** gradient –2, point (–4, 1)

e gradient $\frac{1}{3}$, point (–3, 1) **f** gradient $-\frac{5}{6}$, point (9, –2)

6 Find, in each case, the equation of the straight line with gradient m which passes through the point P. Give your answers in the form $ax + by + c = 0$, where a, b and c are integers.

a $m = 1$, P (2, –4) **b** $m = \frac{1}{2}$, P (6, 1) **c** $m = -4$, P (–1, 8)

d $m = \frac{2}{5}$, P (–3, 5) **e** $m = -3$, $P\left(\frac{3}{2}, -\frac{1}{8}\right)$ **f** $m = -\frac{3}{4}$, $P\left(\frac{2}{3}, -7\right)$

7 Find, in the form $y = mx + c$, the equation of the straight line passing through each pair of points.

a (0, 1) and (4, 13) **b** (2, 9) and (7, –1) **c** (–4, 3) and (2, 7)

d $(-\frac{1}{2}, -2)$ and (2, 8) **e** (3, –2) and (18, –5) **f** (–3.2, 4) and (–2, 0.4)

8 Find, in the form $ax + by + c = 0$, where a, b and c are integers, the equation of the straight line which passes through each pair of points.

a (3, 0) and (5, 2) **b** (–1, 8) and (5, –4) **c** (–5, 3) and (7, 5)

d (–4, –1) and (8, –17) **e** (2, –1.5) and (7, 0) **f** $(-\frac{3}{5}, \frac{1}{10})$ and (3, 1)

9 The straight line l passes through the points A (–6, 8) and B (3, 2).

a Find an equation of the line l.

b Show that the point C (9, –2) lies on l.

10 The point M (k, $2k$) lies on the line with equation $x - 3y + 15 = 0$.

Find the value of the constant k.

C1 COORDINATE GEOMETRY *Worksheet C*

1 The straight line l has gradient -3 and passes through the point with coordinates $(3, -5)$.

a Find an equation of the line l.

The straight line m passes through the points with coordinates $(-1, -2)$ and $(4, 1)$.

b Find the equation of m in the form $ax + by + c = 0$, where a, b and c are integers.

The lines l and m intersect at the point P.

c Find the coordinates of P.

2 Given that the straight line passing through the points $A\ (2, -3)$ and $B\ (7, k)$ has gradient $\frac{3}{2}$,

a find the value of k,

b show that the perpendicular bisector of AB has the equation $8x + 12y - 45 = 0$.

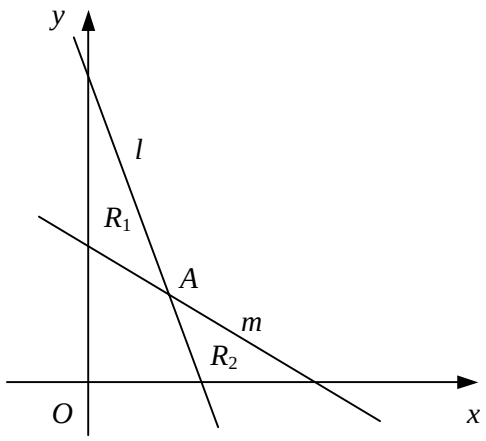
3 The vertices of a triangle are the points $A\ (5, 4)$, $B\ (-5, 8)$ and $C\ (1, 11)$.

a Find the equation of the straight line passing through A and B, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

b Find the coordinates of the point M, the mid-point of AC.

c Show that OM is perpendicular to AB, where O is the origin.

4



The line l with equation $3x + y - 9 = 0$ intersects the line m with equation $2x + 3y - 12 = 0$ at the point A as shown in the diagram above.

a Find, as exact fractions, the coordinates of the point A.

The region R_1 is bounded by l, m and the y-axis.

The region R_2 is bounded by l, m and the x-axis.

b Show that the ratio of the area of R_1 to the area of R_2 is $25 : 18$

5 The straight line l has the equation $2x + 5y + 10 = 0$.

The straight line m has the equation $6x - 5y - 30 = 0$.

a Sketch the lines l and m on the same set of axes showing the coordinates of any points at which each line crosses the coordinate axes.

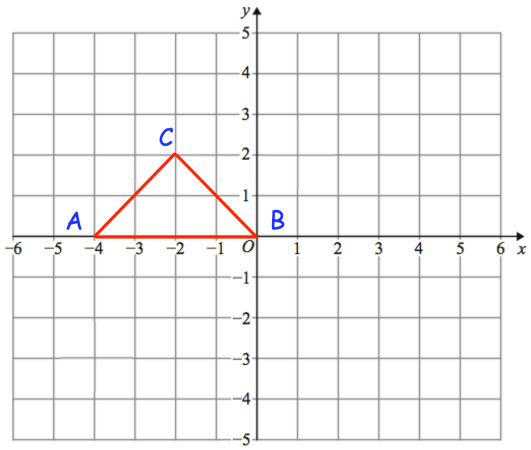
The points where line m crosses the coordinate axes are denoted by A and B.

b Show that l passes through the mid-point of AB.

Invariant Points

Video 392 on www.corbettmaths.com

Apply



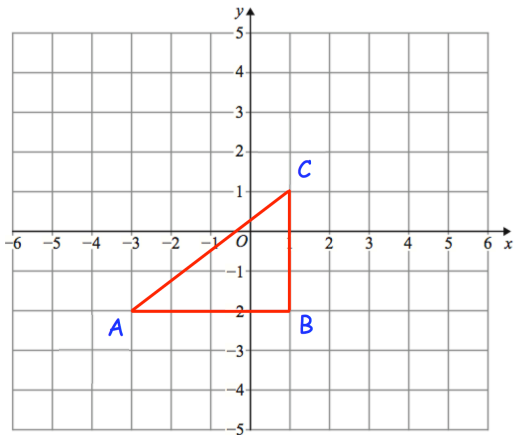
Question 1: ABC is a triangle.

Describe fully a **single** transformation of ABC so that:

(a) None of the vertices are invariant.

(b) Exactly one vertex is invariant.

(c) Exactly two vertices are invariant.



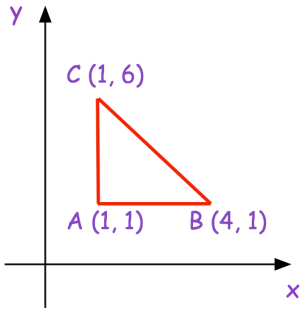
Question 2: Here is triangle ABC

Olivia says "if ABC is reflected in the line $x = -3$ there is one invariant point."

Amelia says "if ABC is reflected in the line $y = -2$ there are two invariant points."

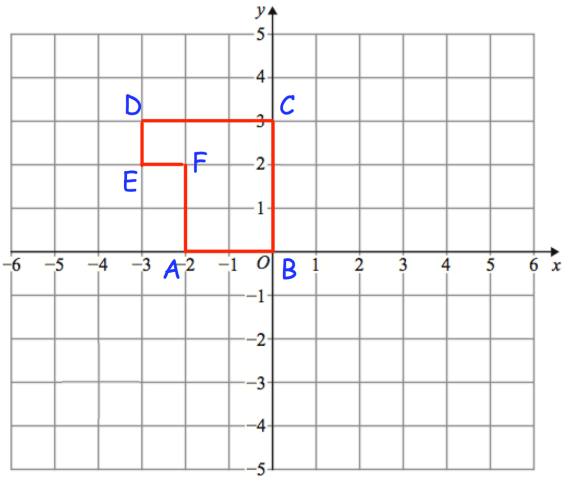
Isla says "if ABC is reflected in the line $x = 1$ there are two vertices that are invariant."

Which student is incorrect? Explain your answer.



Question 3: Here is a sketch of triangle ABC.

Describe fully a **single** transformation of ABC so that all the points on AC are invariant and the point B is not invariant.



Question 4: Here is shape ABCDEF

Describe fully **single** transformations so that from the six vertices:

(a) only vertices B and C are invariant.

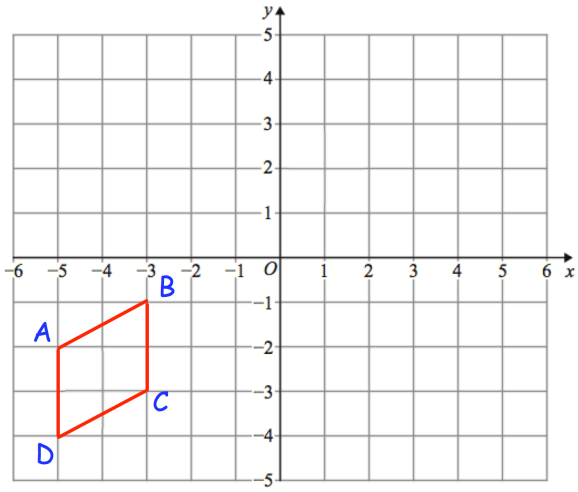
(b) only vertex F is invariant.

(c) only vertices B, D and F are invariant.

Invariant Points

Video 392 on www.corbettmaths.com

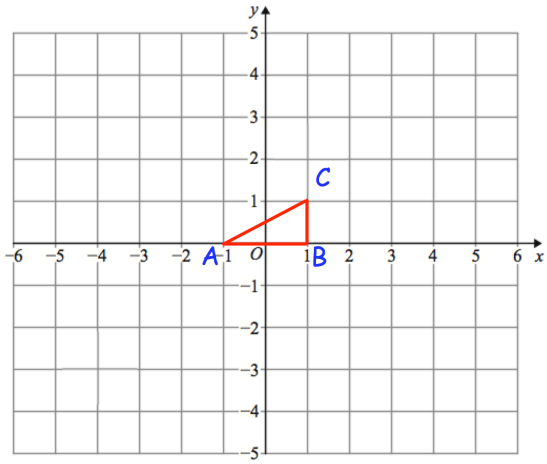
Question 5: Here is quadrilateral ABCD



ABCD is reflected in the line $x = -1$
followed by a reflection in the line $y = -x$
followed by a rotation of 180° about $(-1, -1)$

Which of the vertices are invariant?

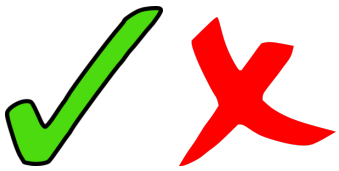
Question 6: Shown is triangle ABC



ABC is rotated 180° about $(-1, 2)$ and then translated by the vector $\begin{pmatrix} 2 \\ -4 \end{pmatrix}$

Write down the coordinate of the invariant point.

Answers



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