

**RADLEY COLLEGE  
Entrance Scholarships**



**MATHEMATICS II**

**March 2011**

Time allowed 1 hour

*Show all working.*

*You may use a calculator*



1. VAT used to be 15%. This means that something with a pre-VAT price of £100 actually costs £115.

(a) How much did I pay for a coat that has a pre-VAT price of £250?

VAT then went up to  $17\frac{1}{2}\%$ .

(b) How much does the coat cost then?

Finally VAT goes up to 20%.

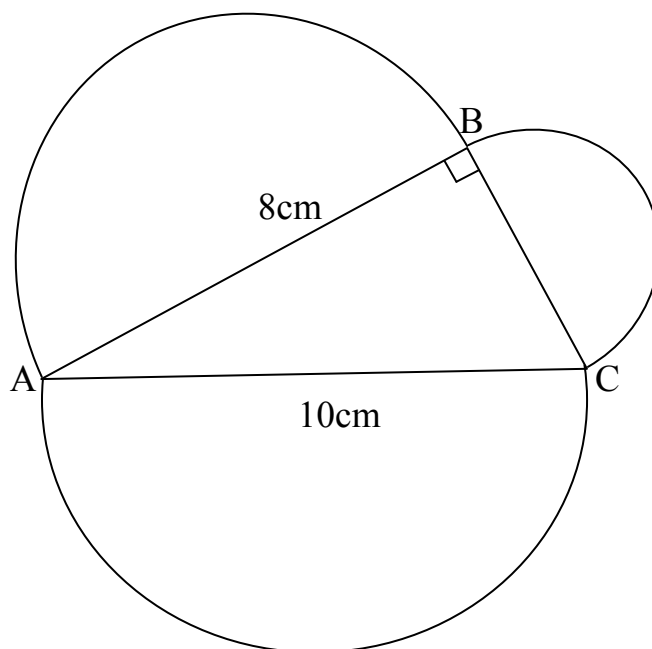
(c) What is the final cost of the coat?

When VAT rose from 15% to  $17\frac{1}{2}\%$  the cost of another coat rose by £10.50. When VAT rose from  $17\frac{1}{2}\%$  to 20% the cost of this same coat rose by another £10.50.

(d) What is the pre-VAT cost of this coat?



2.



ABC is a triangle with a right angle at B.  $AB = 8$  cm and  $AC = 10$  cm. Semicircles are drawn on each of the sides of the triangle as shown in the diagram.

- Find the length of BC.
- Calculate the areas of each of the semicircles, leaving each of your answers as a multiple of  $\pi$ .
- Show that the sum of the areas of the two smaller semicircles is equal to the area of the larger semicircle.
- Can you tell me why, regardless of which right-angled triangle I had chosen to draw, the sum of the areas of the two smaller semicircles will always be the same as the area of the larger semicircle?



*Please turn over*

3. On the journey from Andover to Bedford I average  $50 \text{ kmh}^{-1}$ . On the journey from Bedford to Cambridge I average  $100 \text{ kmh}^{-1}$ . Letting the distance from Andover to Bedford be  $x$  km, and the distance from Bedford to Cambridge be  $y$  km
- (a) Find an expression, in terms of  $x$ , for the time taken to drive from Andover to Bedford.
  - (b) Find an expression, in terms of  $y$ , for the time taken to drive from Bedford to Cambridge.

The whole journey takes 4 hours

- (c) Deduce that  $2x + y = 400$

The total distance is 220 km

- (d) Write down another equation connecting  $x$  and  $y$ .
- (e) Solve these equations to find out the distance from Bedford to Cambridge.



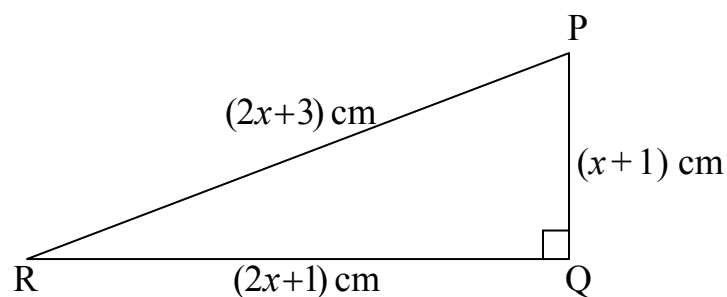
4. (a) Expand and simplify

(i)  $(x+1)^2$

(ii)  $(2x+1)^2$

(iii)  $(2x+3)^2$

(b)



PQR is a right-angled triangle as shown above in which  $PQ = (x+1)$  cm,  $QR = (2x+1)$  cm and  $PR = (2x+3)$  cm. Use Pythagoras's Theorem to find the value of  $x$ .

5. Leaving your answers as fractions

(a) Calculate  $\frac{1}{3} - \frac{1}{5}$

(b) Calculate  $\frac{1}{5} - \frac{1}{7}$

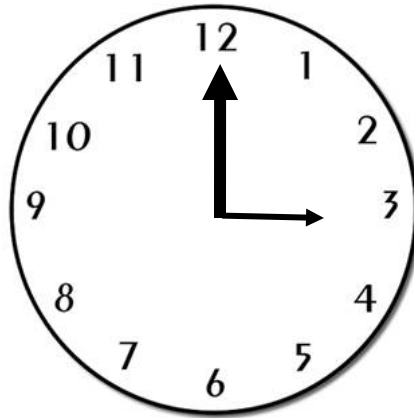
(c) Calculate  $\frac{1}{7} - \frac{1}{9}$

(d) Calculate  $\frac{1}{9} - \frac{1}{11}$

(e) Write down a formula that summarises all of the above calculations.

(f) Justify your formula. [REDACTED]

6.



- (a) What is the angle between the hands of a clock at 3 o'clock?
- (b) Calculate the angle between the hands at 3.30.

At noon the big hand of the clock is pointing in the same direction as the small hand

- (c) How many times between 3am and 3pm will the big hand be pointing in the same direction as the small hand?
- (d) Use your answer to part (c) to calculate, to the nearest second, the first time after 3am when the big hand will be pointing in the same direction as the small hand.

