

For Edexcel

## GCSE Mathematics

Paper 3A (Non-Calculator)

### Higher Tier

Time: 1 hour and 45 minutes



#### Materials required

Ruler, protractor, compasses, pen, pencil, eraser.  
Tracing paper may be used.

#### Instructions and Information for Candidates

Do not write on this question paper – use blank paper and the answer sheets provided.

The total number of marks for this paper is 100. There are 23 questions in this paper.

**Calculators must not be used.**

#### Advice to Candidates

Show all stages in any calculation. Do not spend too long on one question.

If you cannot answer a question, leave it and return to it at the end.

#### Formulae: Higher Tier

**Volume of a prism** = area of cross section  $\times$  length

**Volume of sphere** =  $\frac{4}{3}\pi r^3$

**Surface area of sphere** =  $4\pi r^2$

**In any triangle ABC**

**Sine Rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

**Cosine Rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

**Area of triangle** =  $\frac{1}{2} ab \sin C$

**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

**Curved surface area of cone** =  $\pi r l$

**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$



Written by Shaun Armstrong

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Answer ALL TWENTY THREE questions.

You must write down all the stages in your working.

You must NOT use a calculator.

1.

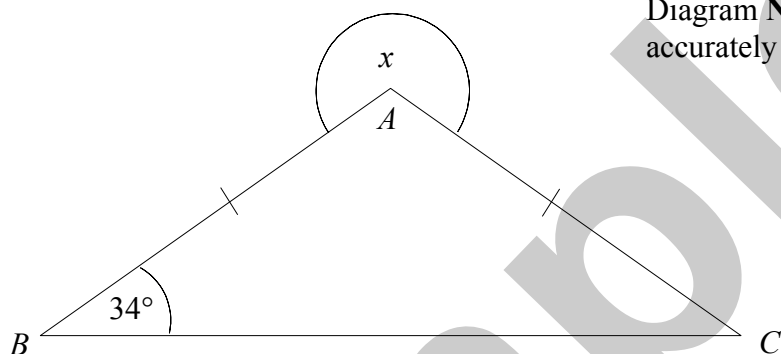


Diagram NOT accurately drawn

In the diagram,  $AB = AC$  and angle  $ABC = 34^\circ$ .

Find the size of the angle marked  $x$ .

(3)

2. The table shows the heights of pupils in a class.

| Height ( $h$ cm)   | Frequency |
|--------------------|-----------|
| $100 < h \leq 110$ | 6         |
| $110 < h \leq 120$ | 9         |
| $120 < h \leq 130$ | 8         |
| $130 < h \leq 140$ | 5         |
| $140 < h \leq 150$ | 1         |

Find the class interval in which the median lies.

(2)

3. (a) Express 56 as the product of its prime factors.

(2)

(b) Find the Highest Common Factor (HCF) of 56 and 84.

(2)

4. (a) On the grid on the answer sheets, draw the graph of  $y = 2x - 3$  (3)

(b) Use your graph to solve the equation  $2x - 3 = 1.4$  (2)

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5. Tariq's bicycle has three gears.

The numbers of teeth on the gears are in the ratio  $5 : 6 : 7$

In total there are 36 teeth on the gears.

(a) Work out how many teeth are on the middle gear. (3)

Tariq cycles 5 kilometres in 20 minutes.

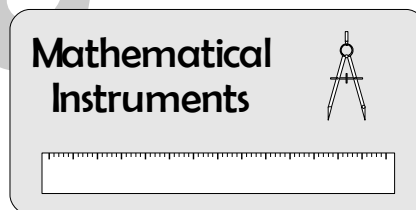
(b) Work out his average speed in kilometres per hour. (2)

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6. Solve  $5p + 9 = p - 3$  (3)

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7.



Instrument Set  
£2.80 + VAT

A set of mathematical instruments costs £2.80 plus  $17\frac{1}{2}\%$  VAT.

(a) Calculate the total cost of the set of instruments. (3)

A school wants to buy 470 sets of mathematical instruments.  
They buy them in boxes of 40.

(b) Work out the number of boxes the school should buy. (2)

8. The table shows the age in days and the heights in centimetres of eight plants.

|             |      |      |      |     |      |      |      |      |
|-------------|------|------|------|-----|------|------|------|------|
| Age (days)  | 36   | 115  | 68   | 23  | 101  | 65   | 38   | 91   |
| Height (cm) | 11.5 | 20.2 | 16.7 | 7.6 | 19.3 | 12.8 | 10.5 | 16.3 |

The first six pairs of values have been plotted on the scatter graph on the answer sheets.

- (a) Plot the last two pairs of values on the scatter graph. (1)
- (b) Describe the **correlation** between the height and age of the plants. (1)
- (c) Draw a line of best fit on the diagram. (1)
- (d) (i) Use your graph to estimate the age of another plant of the same type when it reached a height of 15 cm. (1)
- (ii) Explain why it might not be sensible to estimate the age of a plant of the same type that was 30 cm tall. (3)

9.

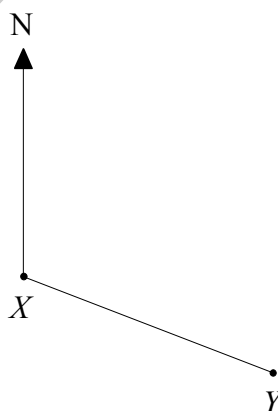


Diagram **NOT** accurately drawn

The bearing of  $Y$  from  $X$  is  $115^\circ$ .

Work out the bearing of  $X$  from  $Y$ .

(2)

10. Work out  $4\frac{1}{5} - 1\frac{2}{3}$

(3)

11. The diagram on the answer sheets shows triangle  $ABC$ .

Shade the region inside the triangle which is nearer to point  $A$  than point  $C$  **and** less than 5 cm from the point  $C$ .

(4)

12. Work out an estimate for the value of  $\frac{916 \times 28.45}{(2.96)^2}$  (3)

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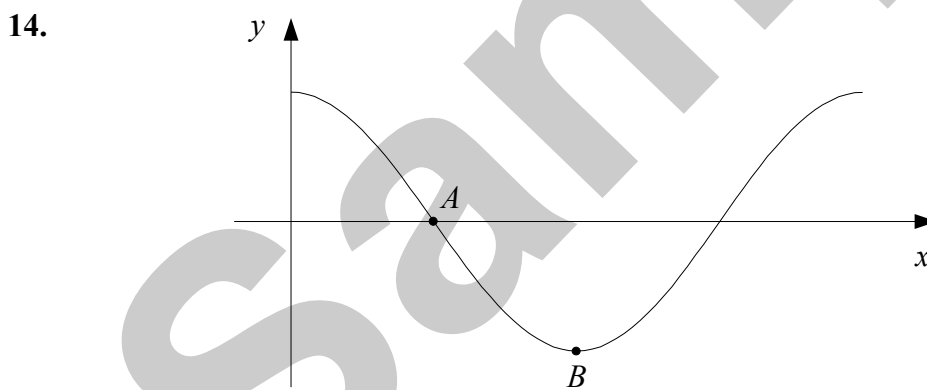
13. (a) Simplify  $(2a)^2$  (1)

(b) Simplify  $\frac{x^5 \times x^2}{x^3}$  (1)

(c) Expand  $y^2(3y - 2)$  (1)

(d) Show that  $x^2 - 8x + 19$  can be written in the form  $(x + a)^2 + b$  for all values of  $x$ . State the value of  $a$  and the value of  $b$ . (3)

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The diagram shows a sketch of part of the graph of  $y = \cos x^\circ$ .

(a) Write down the coordinates of

(i)  $A$ ,

(ii)  $B$ . (2)

(b) On the copy of the diagram above on the answer sheets, sketch the graph of  $y = \cos 2x^\circ$ . (2)

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15. (a) Write down the value of  $9^{-\frac{1}{2}}$  (2)

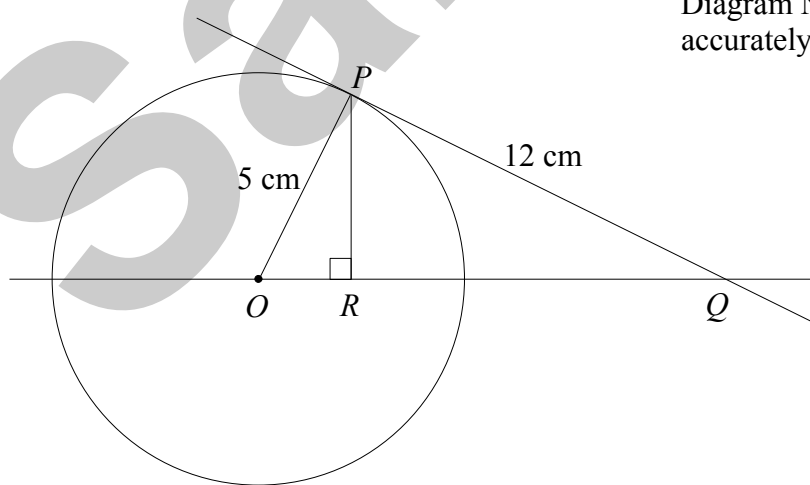
(b) Rationalise the denominator of  $\frac{18}{\sqrt{3}}$  and simplify your answer. (2)

16. Prove algebraically that the sum of three consecutive even numbers is always a multiple of 6. (3)
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17. The table on the answer sheets shows some expressions.  
 $a, b, c$  and  $d$  represent lengths.  
 $\pi$  and 2 are numbers which have no dimensions.  
Tick (✓) the boxes underneath the **three** expressions which could represent volumes. (3)
- 

18. The ages of three sisters are  $x$  years,  $x^2$  years and  $(3x - 2)$  years.  
The total of the ages of the three sisters is 30 years.  
(a) Show that  $x^2 + 4x - 32 = 0$  (2)  
(b) Find the age of the oldest of the three sisters. (3)
- 

19. Diagram NOT accurately drawn



$P$  is a point on a circle, centre  $O$ .  
The line  $PQ$  is the tangent to the circle at  $P$ .  
 $R$  is the point on  $OQ$  such that angle  $ORP = 90^\circ$ .

- (a) Prove that triangle  $OPR$  and triangle  $OPQ$  are similar. (3)

$OP = 5$  cm.  
 $PQ = 12$  cm.

- (b) Find the exact length of  $OR$ . (4)

- 20.** Jenny is marking Question 1 on a set of examination papers.  
The question has two parts and for each part, an answer is either correct or incorrect.

On a paper, the probability that she will mark part (i) correct is  $\frac{3}{4}$

If she marks part (i) correct, the probability that she will mark part (ii) correct is  $\frac{4}{5}$

If she marks part (i) incorrect, the probability that she will mark part (ii) correct is  $\frac{1}{3}$

Jenny marks one paper.

- (a) Complete the tree diagram on the answer sheets. **(3)**

- (b) Work out the probability that she marks both parts correct. **(2)**

One evening, Jenny marks 180 papers.

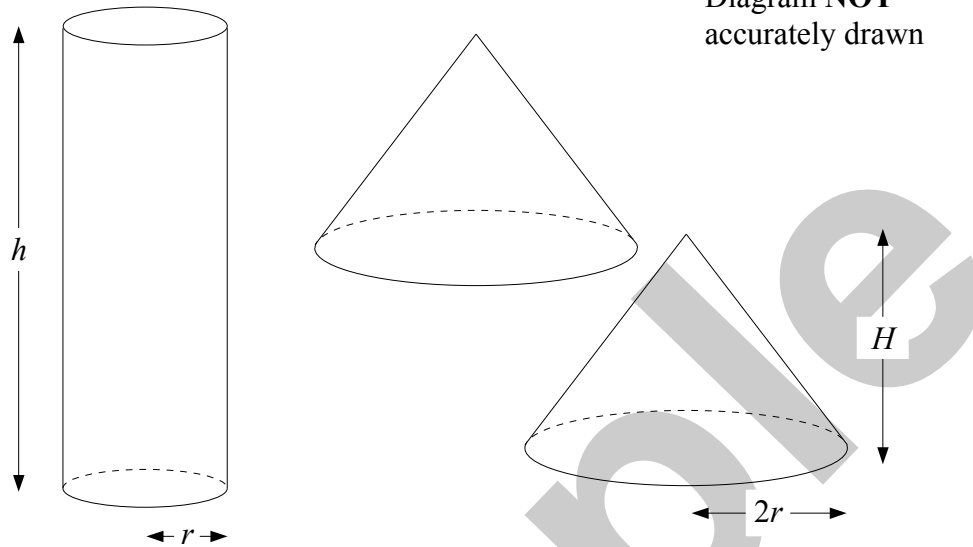
- (c) Work out an estimate for the number of papers on which she marks at least one part correct. **(4)**
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- 21.**  $y$  is inversely proportional to the square of  $x$ .

When  $x = 5$ ,  $y = 8$ .

- Calculate the value of  $y$  when  $x = 2$ . **(4)**

22.



Some plasticine is used to make a solid cylinder of base radius  $r$  cm and height  $h$  cm.

The plasticine is then split in half and used to make two identical cones. Each cone has base radius  $2r$  cm and height  $H$  cm.

Express  $H$  in terms of  $h$ .  
Give your answer in its simplest form.

(4)

23.

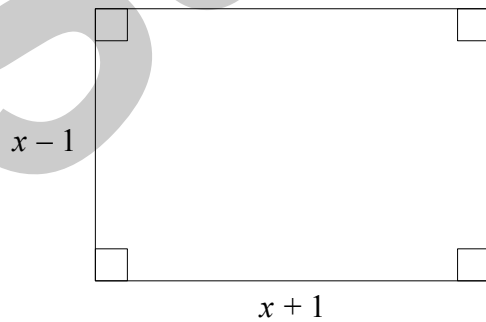


Diagram NOT accurately drawn

The diagram shows a rectangle measuring  $(x - 1)$  cm by  $(x + 1)$  cm.

The diagonals of the rectangle are each 10 cm long.

Find the area of the rectangle.

(6)

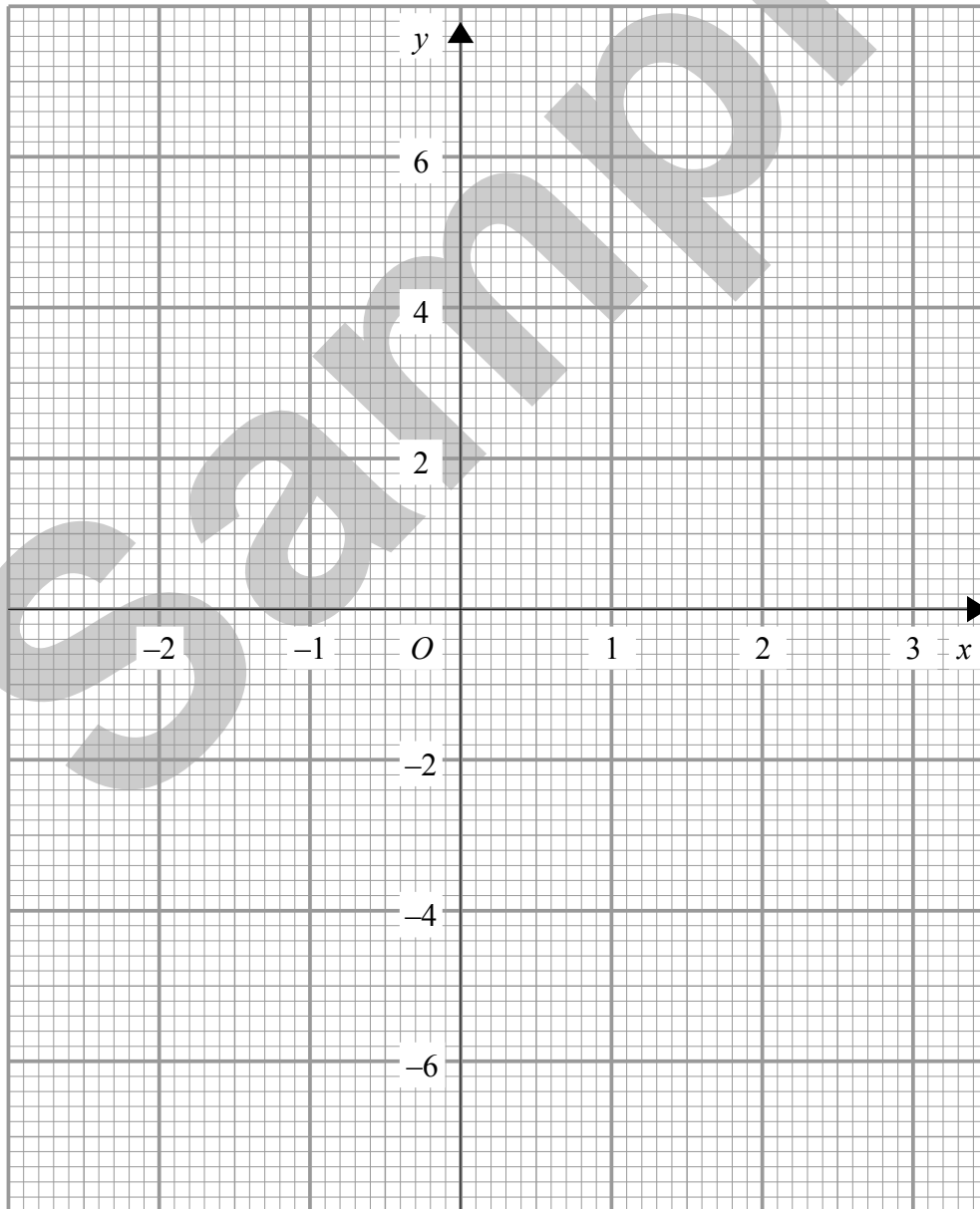
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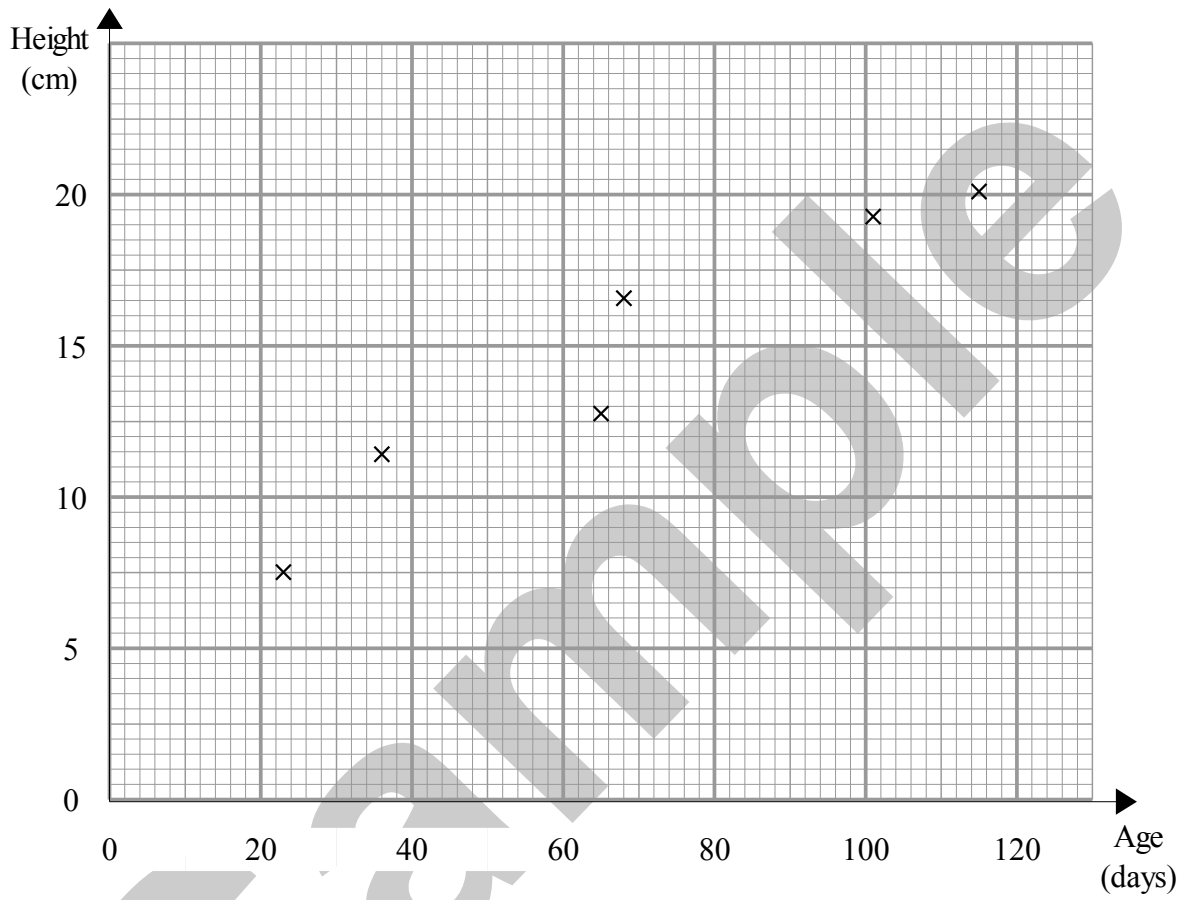
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**Answer Sheets for Higher Tier, Paper 3A**

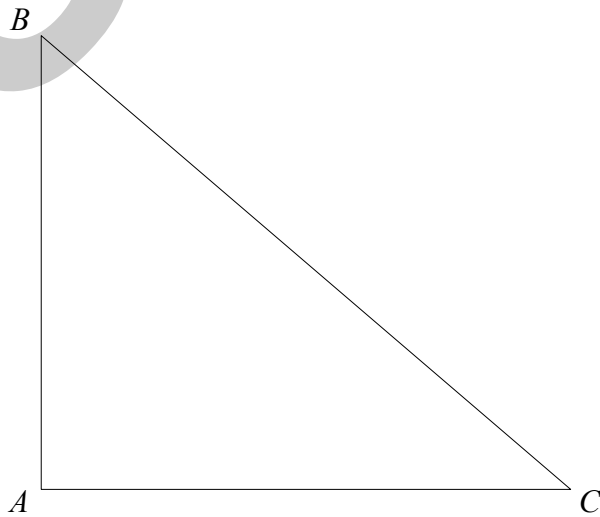
4. (a)



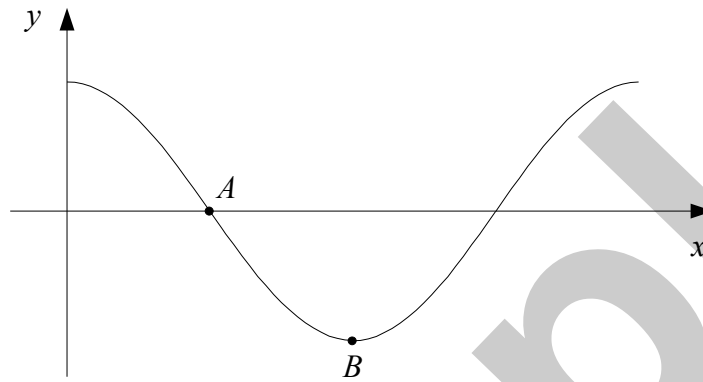
8.



11.



14. (b)



17.

|          |                     |            |           |                  |                |             |
|----------|---------------------|------------|-----------|------------------|----------------|-------------|
| $\pi ab$ | $\frac{a^2 c^2}{d}$ | $2\pi b^3$ | $abc + d$ | $\frac{2d}{b^4}$ | $b(c^2 + d^2)$ | $c^3 + 2ab$ |
|          |                     |            |           |                  |                |             |

20. (a)

