Revision

(1) **Rings** MULTIPLE CHOICE One answer only

True or false? You could write down the definition of the quotient ring (factor ring) R/I, for an ideal I of a commutative ring R.

a. True
b. False

(2) **Rings** MULTIPLE CHOICE One answer only

True or false? You could write down the definition of an *ideal* in a commutative ring.

a. False
b. True

(3) **Linear algebra** MULTIPLE CHOICE One answer only

True or false? Every surjective endomorphism of a finite-dimensional vector space is injective.

a. True
b. False

(4) **Linear algebra** MULTIPLE CHOICE One answer only

True or false? Every injective endomorphism of a finite-dimensional vector space is surjective.

a. False
b. True

(5) **Linear algebra** MULTIPLE CHOICE One answer only

True or false? Every injective endomorphism of a vector space is surjective.

a. True
b. False

(6) **Rings** MULTIPLE CHOICE One answer only

Let I be an ideal of a commutative ring R, and let S be another commutative ring. Which of the following statements is true?

a. The homomorphisms $R/I \to S$ correspond naturally to the homomorphisms $\phi : R \to S$ such that $\ker \phi \supseteq I$.
b. The homomorphisms $R/I \to S$ correspond naturally to the homomorphisms $\phi : R \to S$ such that $\ker \phi \subseteq I$.
c. The homomorphisms $R/I \to S$ correspond naturally to the homomorphisms $\phi : R \to S$ such that $\ker \phi = I$.
d. None of the other statements is true.

(7) **Groups** MULTIPLE CHOICE One answer only

Let N be a normal subgroup of a group G, and let H be another group. Which of the following statements is true?

a. The homomorphisms $G/N \to H$ correspond naturally to the homomorphisms $\phi : G \to H$ such that $\ker \phi \supseteq N$.
b. None of the other statements is true.
c. The homomorphisms $G/N \to H$ correspond naturally to the homomorphisms $\phi : G \to H$ such that $\ker \phi \subseteq N$.
d. The homomorphisms $G/N \to H$ correspond naturally to the homomorphisms $\phi : G \to H$ such that $\ker \phi = N$.

(8) **Groups** MULTIPLE CHOICE One answer only

True or false? You could write down the definition of solvable group.

a. True
b. False

(9) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a finite group and let H be a subgroup of G. Then the order of H divides the order of G.

a. False
b. True

(10) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a finite group and let k be a positive integer that divides the order of G. Then G has a subgroup of order k.

a. True
b. False

(11) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a finite group of order 20. Then G has a subgroup of order 5.

a. False
b. True

(12) **Groups** MULTIPLE CHOICE One answer only

Up to isomorphism, how many groups are there of order < 8?

a. 7
b. 8
c. 9
d. 6
e. 10
f. None of the other answers is correct.

(13) **Rings** MULTIPLE CHOICE One answer only

True or false? Every ideal of a commutative ring R is a subring of R.

a. False
b. True

(14) **Rings** MULTIPLE CHOICE One answer only

True or false? The set of units in a ring is closed under multiplication.

a. True
b. False

(15) **Polynomials** MULTIPLE CHOICE One answer only

True or false? Let f and g be polynomials over a field K. If $f(a) = g(a)$ for all $a \in K$ then $f = g$.

a. True
b. False

(16) **Groups** MULTIPLE CHOICE One answer only

What is the order of the smallest simple nonabelian group?

a. 12
b. 24
c. None of the other answers is correct.
d. 48
e. 6

(17) **Groups** MULTIPLE CHOICE One answer only

What is the order of the smallest non-solvable group?

a. 3
b. 60
c. 24
d. 120
e. None of the other answers is correct.

(18) **Rings** MULTIPLE CHOICE One answer only

True or false? Every integral domain is a field.

a. False
b. True

(19) **Rings** MULTIPLE CHOICE One answer only

True or false? Every field is an integral domain.

a. True
b. False

(20) **Rings** MULTIPLE CHOICE One answer only

True or false? $\mathbb{Z}/n\mathbb{Z}$ is an integral domain if and only if it is a field, for integers $n \neq 0$.

a. False
b. True

(21) **Groups** MULTIPLE CHOICE One answer only

True or false? Every solvable group is abelian.

a. False
b. True

(22) **Groups** MULTIPLE CHOICE One answer only

True or false? Every abelian group is solvable.

a. True
b. False

(23) **Groups** MULTIPLE CHOICE One answer only

True or false? The group A_5 is solvable.

a. True
b. False

(24) **Groups** MULTIPLE CHOICE One answer only

True or false? The group S_5 is solvable.

a. False
b. True

(25) **Groups** MULTIPLE CHOICE One answer only

True or false? The group A_6 is solvable.

a. False
b. True

(26) **Groups** MULTIPLE CHOICE One answer only

True or false? The group S_6 is solvable.

a. False
b. True

(27) **Groups** MULTIPLE CHOICE One answer only

True or false? The group A_4 is solvable.

a. False
b. True

(28) **Groups** MULTIPLE CHOICE One answer only

True or false? The group S_4 is solvable.

a. False

b. True

(29) **Groups** MULTIPLE CHOICE One answer only

True or false? The dihedral group of order 56 is solvable.

a. False
b. True

(30) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a group, let H be a normal subgroup of G, and let K be a normal subgroup of H. Then K is a normal subgroup of G.

a. False
b. True

(31) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a group, let H be a subgroup of G, and let K be a subgroup of H. Then K is a subgroup of G.

a. True
b. False

(32) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a group, let H be a subgroup of G, and let K be a subgroup of H. If K is normal in G then K is normal in H.

a. False
b. True

(33) **Groups** MULTIPLE CHOICE One answer only

True or false? Let G be a group, let H be a subgroup of G, and let K be a subgroup of H. If K is normal in G then H is normal in G.

a. False
b. True

(34) **Groups** MULTIPLE CHOICE One answer only

True or false? You know what it means for one element of a group to be *conjugate* to another.

a. True
b. False

(35) **Groups** MULTIPLE CHOICE One answer only

True or false? You know what it means for one subgroup of a group to be *conjugate* to another.

a. True
b. False

(36) **Groups** MULTIPLE CHOICE One answer only

True or false? Let H and H' be subgroups of a group G. If H and H' are conjugate subgroups then they are isomorphic as groups.

a. True
b. False

(37) **Groups** MULTIPLE CHOICE One answer only

True or false? You could state the first isomorphism theorem for groups.

a. True
b. False

(38) **Rings** MULTIPLE CHOICE One answer only

True or false? You could state the first isomorphism theorem for rings.

a. False
b. True

(39) **Rings** MULTIPLE CHOICE One answer only

True or false? You could state the universal property of quotient rings (factor rings), as stated in Honours Algebra.

a. False
b. True

(40) **Linear algebra** MULTIPLE CHOICE One answer only

In the context of vector spaces, what is an *automorphism*?

a. A linear map from a vector space to itself.

b. A linear map from a vector space to itself that has an inverse.
c. A linear map that has an inverse.
d. None of the other answers is correct.
e. A linear map.

Total of marks: 40